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A TRAFFIC SURVEY OF *MICROTUS-REITHRODONTOMYS* RUNWAYS

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Patient observation of the comings and goings of individual birds has long been one of the most rewarding activities of ornithologists. The development in recent years of inexpensive electronic flash photographic equipment has made it possible and practical for mammalogists to make similar studies on this aspect of the natural history of secretive small mammals. The report that follows is based on photographic recordings of the vertebrate traffic in mouse runways over a period of 19 months. Species, direction of travel, time, temperature and relative humidity were recorded for each passage. In addition, many animals in the area were live-trapped and marked to make it possible to recognize individuals using the runways.

THE APPARATUS

Two recorders were used. Each consisted of an instrument shelter and a camera shelter. Each instrument shelter was a glass-fronted, white box containing an electric clock with a sweep second hand, a ruler for measuring the size of photographed individuals, a dial thermometer and a Serdex membrane hygrometer. The ends of the box were louvered to provide circulation of air as in a standard weather station. This box was placed along one side of the runway, across from the camera shelter, so that the instruments were visible in each photograph (Plate I). The camera shelter was a glass-fronted, weatherproof box containing a 16-mm. motion picture camera synchronized to an electronic flash unit. In one of the recorders the camera was actuated by a counterweighted treadle placed in the mouse runway immediately in front of the instrument shelter (Plate I, bottom). An animal passing along the runway depressed the treadle, thereby closing an electrical circuit through a mercury-dip switch. This activated a solenoid that pulled a shutter-release pin so arranged that the camera made a single exposure. The electronic flash fired while the shutter was open. This synchronization was easily accomplished by having the film-advance claw close the flash contact. The camera would repeat exposures as rapidly as the treadle could be depressed, but at night about three seconds were required for the flash unit to recharge sufficiently to give adequate light for the next exposure.

The other recorder was actuated by a photoelectric cell instead of by a treadle. A beam of deep red light shone from the camera shelter across the runway and was reflected back from a small mirror in the instrument shelter to a photoelectric unit in the camera shelter. When an animal interrupted the light beam, the photoelectric unit activated a solenoid that caused the camera to make a single exposure, as in the other recorder.

To avoid the possibility of frightening the animals it would be desirable to use infra-red–sensitive film and infra-red light, but standard electronic flash tubes emit so little energy in the infra-red that this is not practical. Instead, I used 18 layers of red cellophane over the flash tube and reflector to give a deep red flash of light. Wild mice, like many laboratory rodents, are probably insensitive to deep red light. I found no evidence that the flash, which lasts for only 1/1000th of a second, frightened the mice. A muffled clunk made by the mechanism also seemed not to alarm the mice unduly.

When the camera diaphragm was set to give the proper exposure at night, daytime pictures were overexposed, since the shutter speed was considerably slower than 1/30th of a second. To reduce the daytime exposure, a red filter was put on the camera lens. The filter did not affect night exposures because red light from the flash passed the red filter with little loss. In addition, on one of the cameras the opening in the rotary shutter was reduced to give a shorter exposure.

Both recorders function on 110-volt alternating current. The treadle-actuated one could be adapted to operate from batteries. The units continue to record until the motion picture camera runs down or runs out of film. One winding serves for several hundred pictures. The film record can be studied directly by projecting the film strip without making prints.

The camera shelter and instrument shelter had overhanging eaves to prevent condensation of frost and dew on the windows. A small blackened light bulb was also kept burning in the camera shelter to raise the temperature enough to retard fogging on the glass. Animals were encouraged to stay in their usual runway by a picket fence made of twigs or slender wires. No bait was used.

A few individual animals could be recognized in the pictures by scars or molt patterns, but most had to be live-trapped and marked. Using eartags and fur-clipping I was able to mark distinctively (Plate I, bottom) all of the mice captured at any one station. The clipping remained visible for days or months depending upon the time of the next molt.

The apparatus produces photographic records such as those shown in the lower pictures in Plate I. These can be transposed into some form as Fig. 2.

THE STUDY AREA

The study centered around a grassy-weedy patch surrounding a brush pile in Orinda, Contra Costa County, California (Plate I). The runways wound through a 20 × 20-foot patch of tall weeds (*Artemisia vulgaris, Hemizonia* sp. and *Rumex crispus*) and under the brush pile. The weeds were surrounded

by and somewhat intermixed with annual grasses. Oaks and other trees, as well as a house and planting, were 50 feet away.

Summer climate in this region is warm and sunny with official mean daily maximum temperatures rising above 80°F. in late summer. Official temperatures occasionally reach 100°, and temperatures in the small instrument shelters used in this study sometimes exceeded this. Nights in summer are usually clear and with the mean daily minimum temperature below 52° in each month. About 27 inches of rain fall in the winter and there is frost on most clear nights. The mean daily maximum temperature in January, the coldest month, is 54°, and the mean daily minimum 31°.

PROCEDURE

I placed the first recorder in operation on January 29, 1956, and the second on October 19, 1956. Except for occasional periods of malfunction and a few periods when I was away they continued to record until the end of the study on September 10, 1957. Approximately 778 recorder-days or 111 recorder-weeks of information were thus obtained. The monthly distribution of records was as follows: January, 54 days; February, 70; March, 90; April, 80; May, 84; June, 67; July, 52; August, 88; September, 48; October, 33; November, 52; and December, 60.

The recorders were placed at what appeared to be frequently used *Microtus* runways, usually situated on opposite sides of the weedy patch 20 to 30 feet apart. For one period of four months one of the recorders was placed at a similar weedy patch 70 yards away. Early in the study it was discovered that a neighbor's Siamese cat sometimes crouched on the camera shelter waiting for mice to pass along the exposed runway in front of the instrument shelter. Consequently, a 2½-foot fence of 2-inch-mesh wire netting was set up enclosing most of the weedy patch. This prevented further predation by cats at the center of the study area, although cats continued to hunt outside of the fence a few yards away from the recorders. The only other tampering with predation was the removal of two garter snakes on April 11, 1957.

RESULTS

Traffic in individual runways.—The recorders were operated at eighteen different stations. At seven of these apparently busy runways a traffic volume higher than a few passages per day never developed, and so the recorders were moved within two weeks. Perhaps the mice originally using these runways had abandoned them or had been killed shortly before a recorder was moved to their runway, or perhaps the disturbance of placing a recorder caused the mice to divert their activities to other runways. At the other eleven stations a satisfactory volume of traffic was maintained for three to more than twenty weeks. A station was abandoned and the recorder moved when the traffic had decreased to a few passages per day. Subsequently, I found that even this little activity does not indicate that the mice are going to abandon the runway,

for on several occasions traffic in a runway dropped this low and then climbed again to high levels. At one recorder the total number of passages in consecutive weeks was 183, 84, 26, 75 and 203. The runway represented in Fig. 1 was one of those used most consistently, but even it shows marked daily and weekly fluctuations. It is probable that after a few weeks of disuse during the season when grass and weeds are growing rapidly, a runway would not be reopened, but during the rest of the year an abandoned runway remains more or less passable and probably more attractive to mice than the surrounding terrain.

Figure 1 summarizes the traffic in one of the busiest runways. On the first night there were an unusual number of records of harvest mice whose curiosity may have been aroused by the apparatus. Obviously they were not frightened away. After a short time traffic increased to a high level and remained high until the middle of November, when passages by *Microtus* decreased sharply. During the week before the decrease, seven marked individuals provided most of the *Microtus* traffic. One of these individuals, an infrequent passerby, disappeared at the time of the decrease, but the other six remained nearby for at least another week and continued to pass occasionally. Those *Microtus* that disappeared later were replaced by others so that even the infrequent passages in late November and early December were being provided by seven marked individuals. The decrease of *Microtus* traffic was caused, therefore, not by deaths but by a change in runway preference. Several of these same individuals were using another runway 20 feet away in mid-January, February and March.

Three to six marked *Reithrodontomys,* depending upon the date, were providing most of the harvest-mouse traffic in the runway represented in Fig. 1. The average number of passages per day of animals of all kinds was eighteen. In the ten other most successful runways, the average number of passages per day ranged from two to nineteen.

Figure 2 gives a detailed accounting of the traffic at a single recording station for six days. One can judge from this figure the kind of information (excluding

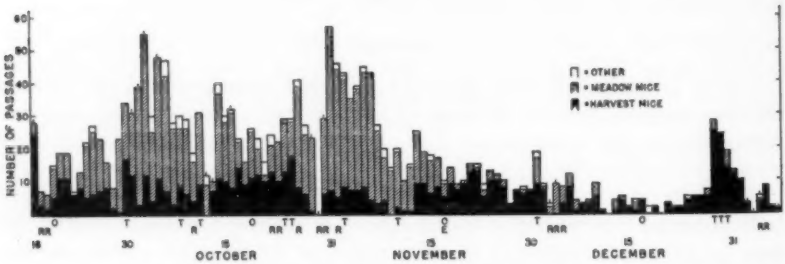

FIG. 1.—Traffic volume along one runway for 16 weeks. Meaning of symbols under the base line: *T*= live-trapping carried out for part of this day; *O*= full moon; *E*= total eclipse of the moon; *R*= rain. Columns surmounted by a vertical line represent days for which the recording was incomplete; the heights of the various segments of these columns should be considered minimum values.

temperatures and humidities) obtained with the recorders and can at the same time catch a revealing glimpse of an aspect of the biology of small mammals that has heretofore been revealed inadequately by trapping and other techniques. It may be seen that the mouse traffic was provided by one female and two male harvest mice and by three male, three female, and one or more unidentified meadow mice; together they gave between 15 and 24 passages each day. No individual passed more than eight times in one day. One harvest mouse (R2) seemed to spend the day to the left and to make a single excursion

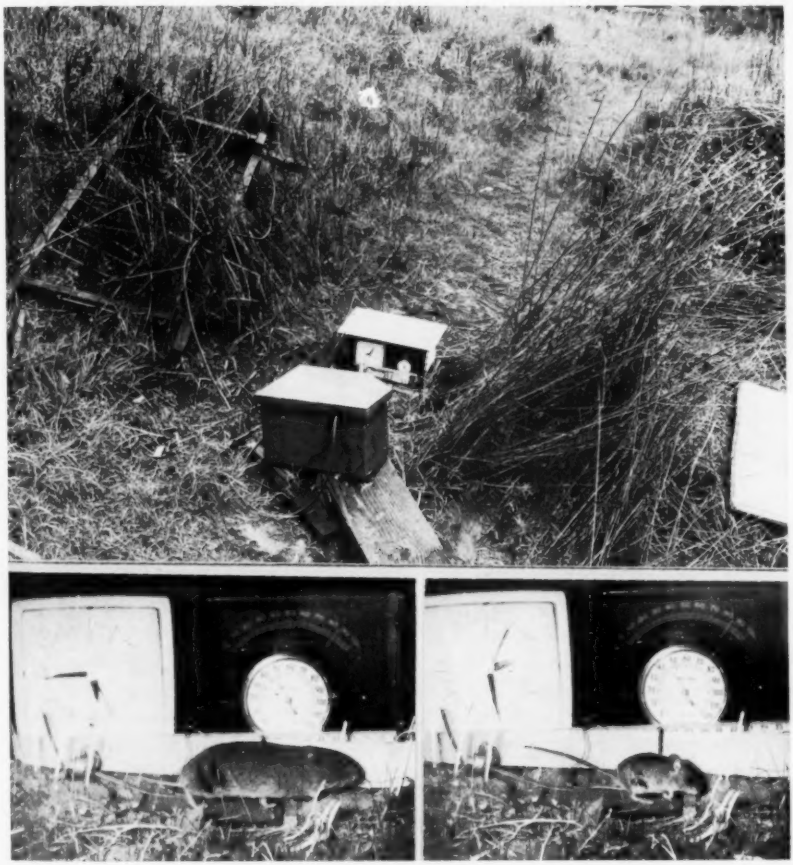

PLATE I

TOP: Camera shelter (foreground) and instrument shelter in position at a mouse runway on the study area. BOTTOM: The kind of records obtained with the recorder; *left*—a meadow mouse marked by clipping two strips of fur on the hips; *right*—a marked harvest mouse crossing the treadle.

to the right each night. Harvest mice first appeared in the evening between 6:37 and 7:22 and none passed after 6:26 in the morning. Five or six *Microtus* passed within a few hours (February 24), and there was nightly near-coincidence of *Reithrodontomys* and *Microtus*.

Traffic in all runways combined.—During the 111 recorder-weeks, the following passages of animals were photographed:

Meadow mouse, *Microtus californicus*	6,077
Harvest mouse, *Reithrodontomys megalotis*	1,753
Bird (see following account)	382
Brush rabbit, *Sylvilagus bachmani*	94
Shrew, *Sorex ornatus*	56
Peromyscus (see following account)	39
Fence lizard, *Sceloporus occidentalis*	33
Garter snake, *Thamnophis* sp.	17
Salamander (see following account)	11
Alligator lizard, *Gerrhonotus* sp.	10
House cat, *Felis domesticus*	6
Newt, *Taricha* sp.	5
Pocket gopher, *Thomomys bottae*	3
Gopher snake, *Pituophis catenifer*	3
Mole cricket, *Stenopelmatus* sp.	2
Ground squirrel, *Citellus beecheyi*	1
Weasel, *Mustela frenata*	1
King snake, *Lampropeltis getulus*	1
Racer, *Coluber constrictor*	1
TOTAL	8,495

On the basis of trapping results in this and in similar habitat nearby, large numbers of meadow mice and harvest mice were expected. The recording of at least 26 other species in the runways came as a pleasant surprise. Whereas all of these species would be expected to record their presence eventually, some of them are rarely seen or trapped near this location. After living five years on the study area, after doing considerable field work nearby, and after checking the recorders twice each day during the study, I have not yet seen a weasel or a ground squirrel within at least a mile of the study area. Weasels could easily escape detection, but large, diurnal ground squirrels must be very rare. The single individual recorded on August 31 may have been a young squirrel emigrating from some distant colony. Noteworthy absences were those of wood rats (*Neotoma fuscipes*), moles (*Scapanus latimanus*), and probably California mice (*Peromyscus californicus*), all of which were common within 100 feet of the recorders. An opossum (*Didelphis marsupialis*) was seen a few feet from one of the recorders but did not appear on the films. No house mice (*Mus musculus*) were detected in the photographs, although

it is possible that some passages of *Mus* were listed as of *Reithrodontomys*. House mice were caught occasionally in houses nearby and in a field near a poultry house 200 yards away, but none was caught during frequent live-trapping near the recorders.

The total of 8,495 passages of animals gives an average of 11 passages per day in each runway. A patient, non-selective predator waiting for a single catch at runways such as these could expect, theoretically, a reward each 2.2 hours. The mean weight of animal per passage was about 31 grams, which would yield approximately 40 calories of food. This much each 2.2 hours would be more than enough to support an active mammal the size of a fox.

Meadow mouse.—The 6,077 *Microtus* passages were distributed throughout the day and night as shown in Fig. 3 (above). The hours of above-ground activity, however, were quite different in winter than in summer, so Fig. 3 is only a year-around average somewhat biased by the fact that more *Microtus* were recorded in the spring than in the other seasons. A more detailed analysis of the *Microtus* data will be given in a later report. By marking as many of the mice as possible, it was found that usually four or more individual *Microtus* were using each runway but rarely more than ten. On some occasions more than 60 *Microtus* passages were recorded at a single point in 24 hours.

Harvest mouse.—Harvest mice were almost entirely nocturnal (Fig. 3, center). They not only used the *Microtus* runways, but their passages were frequently intermixed with those of *Microtus* (Fig. 2). On fourteen occasions the two species passed within 60 seconds of each other, and on one occasion

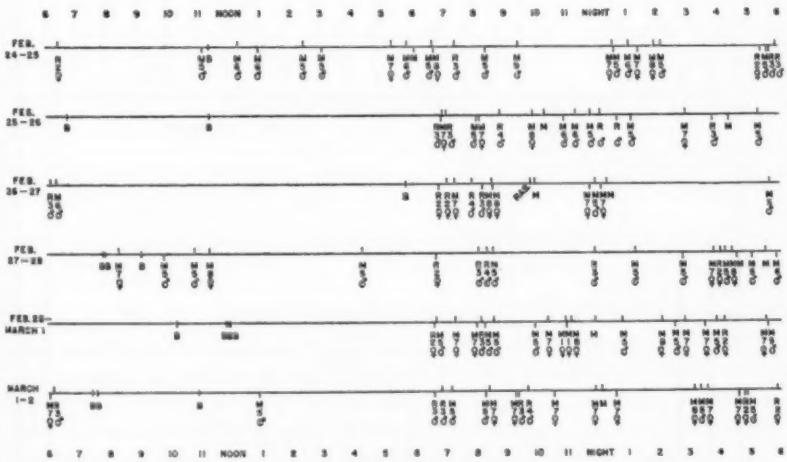

FIG. 2.—A sample record of the total traffic in a single runway over a period of six days. Marks above the base lines indicate passages from right to left, and marks below the base line passages from left to right. *R* represents *Reithrodontomys*; *M*, *Microtus*; *B*, bird (includes brown towhee, wren-tit, and song sparrow); and *RAB*, brush rabbit. Most of the mice are further identified by number and sex.

a 4-month-old male *Microtus* and a 5-month-old male *Reithrodontomys* appeared in the same photograph.

The history of one runway indicates that traffic by *Reithrodontomys* alone does not keep a *Microtus* runway open. One or more *Microtus* passed almost daily along this runway during February. At the end of the month the *Microtus* disappeared and two *Reithrodontomys* became active in the same runway. Despite an average of 3.3 passages per day by *Reithrodontomys* throughout March and up to mid-April, grass and weed seedlings grew up

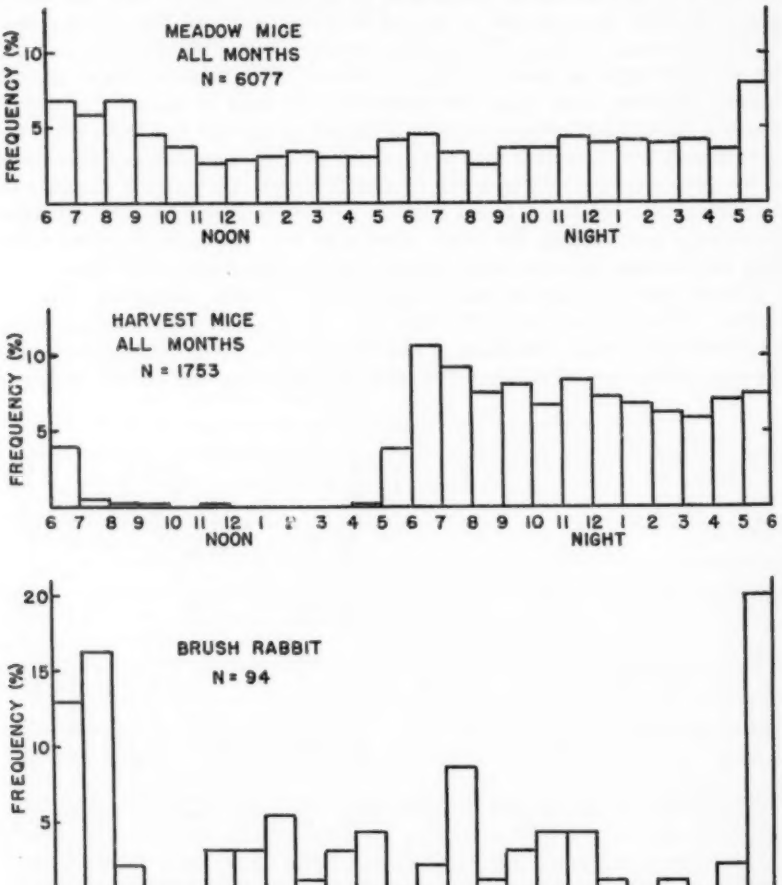

FIG. 3.—Distribution by hours of 6,077 passages of meadow mice (above); 1,753 passages of harvest mice (center); and 94 passages of brush rabbits (below).

in the runway and it began to look unused. By the end of April almost all traffic had ceased.

The *Reithrodontomys* data will be analyzed in a later report.

Birds.—Of the 382 bird records, at least 255 were of sparrows (at least 122 song sparrow; the remainder mostly fox sparrow, white-crowned sparrow and golden-crowned sparrow). Other birds recognized were wren-tit, wren, brown towhee and thrush. On several occasions birds, especially song sparrows, battled their reflections in the window of the instrument shelter. This caused long series of exposures. Each series was counted as a single passage. If the bird stopped for a minute or more and then returned to the battle, this was counted as another passage. All bird records were during daylight hours.

On three occasions a sparrow and an adult *Microtus* appeared in the same photograph. On one of these occurrences a song sparrow was battling its reflection when an adult, lactating *Microtus* came along the runway. The sparrow retreated about 12 inches toward the camera shelter and, as soon as the mouse had passed, returned to the runway.

Brush rabbit.—All except four of the records of brush rabbits were in June and July of 1957, a season when these animals, especially young ones, were abundant. Figure 3 (below) shows that they were most active in the early morning.

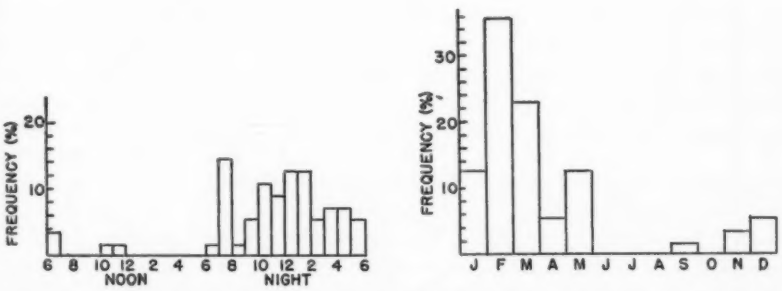

FIG. 4.—Distribution by hours of 56 passages of shrews (left) and distribution by months of 56 passages of shrews (right).

Shrew.—The dry, weedy habitat chosen was not favorable for shrews, and they were near the minimum weight necessary to depress the treadle of one of the recorders, so that some may have passed along the runway without making a record. The shrews were highly nocturnal (Fig. 4, left) and avoided the surface runways during the dry summer months (Fig. 4, right). Since captive specimens of *Sorex* are rarely inactive for more than one hour (Morrison, Amer. Midl. Nat., 57: 493, 1957), the scarcity of records in the daytime probably means only that the shrews were not moving above ground at this time. They may have been foraging along gopher, mole and *Microtus* tunnels during the daytime.

A shrew was marked on March 4, a few inches from one of the recorders. It was captured 15 feet away on May 30 and 5 feet farther away on June 23. It passed along the study runway five times in the 16-week interval between first and last capture: on March 13, 27, 31, and April 17, and possibly on April 10 (markings obscured). Another shrew was recorded on March 27. Unless baited traps attract shrews from a considerable distance, or the recorder repels them, a trapper setting traps in this runway for a few nights would have had small chance of recording the presence of this individual which apparently was nearby for at least 16 weeks.

Not a single shrew was recorded during the dry summer months of June, July and August. Nevertheless, on July 8 when I was checking the photoelectric recorder at 5:55 AM, a shrew emerged completely from a small hole in

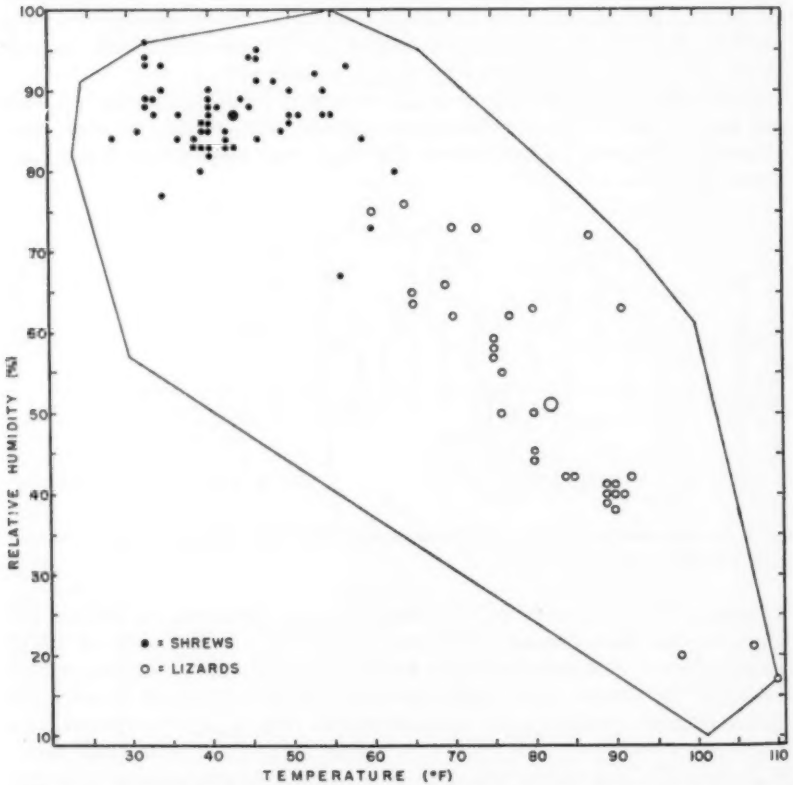

FIG. 5.—A comparison of the temperatures and humidities encountered by shrews and fence lizards in the runways. The larger circles show the position of the mean for each species. The large polygon encloses the range of temperatures and humidities available to the animals during the study.

the ground a few inches from the instrument shelter, twitched his nose rapidly for a few seconds, and retreated down the same hole. The air temperature was 54° and the relative humidity 78 per cent—normal for this season. Obviously shrews were present on the study area during some or all of the summer months but were not frequenting the surface runways.

Figure 5 shows the temperatures and relative humidities encountered above ground by the shrews on the study area compared with the total range of temperatures and humidities recorded throughout the study. By their nocturnal, winter-time activity shrews encountered the coldest, most humid conditions available in the region. In contrast, the similarly small, insectivorous fence lizards existing in the same habitat managed by their own behavioral patterns to encounter a totally different climate (Fig. 5). The mean of the temperatures recorded at the times of lizard passages was 39° warmer than that recorded for shrew passages, and relative humidity was 36 per cent lower.

This activity pattern of shrews differs from that reported by Clothier (Jour. Mamm., 36: 214–226, 1955) for *Sorex vagrans* in Montana. He found shrews there to be active "both day and night and throughout the year, even during extremely bad weather." It is important to understand, however, that he collected in damp areas near water, where the shrews may not have had to modify their activity to avoid desiccation. Extremely bad weather, for a shrew, is hot dry weather.

Peromyscus.—Peromyscus truei was abundant in brushy places and in houses nearby; *P. maniculatus* was scarce. Some of the *Peromyscus* records were clearly of *truei* and some may have been of *maniculatus*, but many could not be identified with certainty. No adult *P. californicus* was recognized although a few young ones may have passed and been listed as *truei*. All passages of *Peromyscus* were at night.

Salamander.—The record includes passages by both *Ensatina escholtzii* and *Aneides lugubris*. They were recorded in October, November, March and April. By being nocturnal and by avoiding the dry season, they encountered in these autumn and spring months about the same microclimate as shrews, but were recorded neither in the winter months nor at temperatures below 39°. A third species, *Batrachoceps attenuatus*, was common in the study area but is so small that it could not be expected to actuate either of the recorders. One *Batrachoceps* electrocuted itself underneath the treadle but has not been included in the records.

Comparison of traps and recorders.—The combination of live-trapping and photographing revealed a failure of small mammals to move between runways only a few feet apart. On several occasions meadow mice and harvest mice were live-trapped a few feet from one of the recorders, were released at the same place, and were recaptured a week or more later not more than a few feet away, yet during the intervening time they failed to pass the recorder. Conversely, some individual mice repeatedly recorded themselves on the films yet could never be induced to enter any of a large number of live traps placed

in the same runway and in nearby runways. It is obvious that all mice present do not use all of the active runways close to their home, and it is also obvious that neither the recorders nor traps give a complete accounting of the mice present.

SUMMARY

A motion-picture camera synchronized to an electronic flash unit was used to record the passage of animals along meadow-mouse runways and to record the temperature, relative humidity and time at which they passed. More than 26 species used the runways during 111 weeks of recording. Meadow mice, harvest mice, sparrows, brush rabbits and shrews passed most frequently. The average traffic per day in each runway was 11 passages; on some days there were more than 60 passages. Rarely more than ten meadow mice or six harvest mice used a runway in any one period. Meadow mice and harvest mice used the same runways simultaneously. Traffic by harvest mice alone did not keep the runways open.

Meadow mice were active during the day and night; harvest mice were strongly nocturnal. Brush rabbits were active primarily early in the morning. Almost all shrews were recorded at night and in the winter months. Consequently, they encountered the coldest, most humid conditions available to them. In contrast, the similarly small, insectivorous fence lizards encountered a microclimate that was 39° warmer and 36 per cent less humid.

Neither traps nor recorders accounted for all the individuals living nearby.

Museum of Vertebrate Zoology, Berkeley, California. Received October 29, 1957.

THE REPRODUCTIVE CYCLE OF THE EASTERN MOLE

By C. H. Conaway

Although the eastern mole, *Scalopus aquaticus*, is widely distributed over much of the central and eastern United States, relatively little is known about its reproductive cycle. It is commonly stated that breeding is in the spring and occurs earlier in the south than in the north (Jackson, 1915; Hamilton, 1943). One litter of about four young is produced each year (Scheffer, 1909; Jackson, 1915). Gestation is about five (Scheffer, 1909) to six weeks (Arlton, 1936). Young of the year do not breed (Scheffer, 1909). Corroborative data supporting these statements and other additional information about the female cycle are given in this study. The male cycle is treated in more detail since other workers have not considered this subject.

MATERIALS AND METHODS

Collections of *Scalopus* from several areas over the geographic range have been made. Those specimens which were personally collected (Missouri, Indiana, and the majority of the Wisconsin material) were taken in choker loop traps. They were brought into the laboratory and autopsied usually within 12 hours after death. Gross weights and measurements were taken, the

skulls preserved, and reproductive tracts fixed in A.F.A. or Zenkerformol. Age determination was based upon toothwear criteria. Animals were classed either as young (born in the calendar year in which they were collected) or adult (born in a calendar year previous to the one in which they were collected). The material available is as follows:

1. Dane County—south-central Wisconsin. 194 specimens taken between late March and mid-December of 1952 and 1953. No specimens were obtained through the winter when the ground was frozen.
2. Dearborn County—southeastern Indiana. 45 specimens taken in February, 1953.
3. Boone County—central Missouri. 157 specimens from all months of the year. The material was collected from September, 1954 until March, 1957.
4. Dane County—south-central Wisconsin. 27 female reproductive tracts collected in April and May, 1940, by Dr. H. W. Mossman.
5. Independence County—north-central Arkansas. 22 reproductive tracts from specimens taken November, 1952 through April, 1953, by W. L. Henning.

One ovary from each female has been serially sectioned. Serial sections of both ovaries from a few specimens are available. Corpora lutea counts which are recorded below were made from the latter group. One uterine horn from pre-implantation specimens has been sectioned.

Both fixed testes from each male were weighed on a Roller-Smith balance. Prostate gland weights similarly taken are available from a part of the Missouri collection. Histological sections of testis, tail of epididymis, and prostate were made from each male animal.

THE FEMALE REPRODUCTIVE CYCLE

Breeding season.—The breeding season of *Scalopus* is restricted to three or four months in the spring and the majority of the females are bred within a period of three or four weeks (Table 1). In the Wisconsin population the peak of breeding appears to occur in the last week of March and the first week of April. During the period March 20 to July 15, 97 adult females were taken of which 47 were pregnant. Only five pregnant females were collected after May 5, including one very late pregnancy on July 4. Since no specimens were taken prior to March 20, the only indication that there is little breeding activity in early March is that none of the 11 specimens collected in late March was parous and only two parous animals were taken before April 10.

Apparently the breeding season is about one month later in Wisconsin than in Missouri where the maximum breeding activity occurs in February and the first week of March. Scanty data suggest that the height of the breeding season is in February in both southern Indiana and Arkansas. The reproductive status of all adult female specimens taken between January 1 and July 31 is given in Table 1. A summary of the periods of maximum breeding activity of *Scalopus* in various geographic areas is given in Table 2.

TABLE 1.—*Reproductive status of adult female Scalopus; the numbers of individuals in each category are given by half-month intervals for four populations*

REPRODUCTIVE CATEGORY	JAN.	FEB.	MAR.	APRIL	MAY	JUNE
Wisconsin:						
Inactive	— —	— —	— 2	2 1		
Estrus	— —	— —	— 1	4 1		
Unimplanted	— —	— —	— 5	5 3	1 1	
Implanting	— —	— —	— 2	3 2	— 1	
Late pregnancy	— —	— —	— 1	7 13	2 1	
Post-partum	— —	— —	— —	3 14	6 17	3 3
Arkansas:						
Estrus	— —	3 —				
Late pregnancy	— —	— —	1 —			
Post-partum	— —	— —	1 2	1 —		
Missouri:						
Inactive	6 —	— —	1 —			
Estrus	— —	— —	3 —			
Unimplanted	— 1	4 —	1 —			
Implanting	— —	— —	1 —			
Late pregnancy	— —	— —	3 —			
Post-partum	— —	— —	1 1	1 3	3 —	
Indiana:						
Estrus	— —	2 1				
Implanting	— —	— 1				
Late pregnancy	— —	— 2				

Age at sexual maturity.—There is no indication that young females breed during the year they are born. All animals judged as young of the year possessed infantile uteri and showed no other indication of having bred that year. All animals which were one year or older in age were either pregnant or parous. No adult female appeared to have passed through a breeding season without becoming pregnant.

Number of litters per year.—Only one litter is produced each year. No pregnant females were collected that appeared to have been recently parous as determined by the gross and microscopic condition of the mammary glands

TABLE 2.—*Geographic variation in breeding season of Scalopus*

LOCALITY	EARLIEST PREGNANCY	LATEST PREGNANCY	MAXIMUM BREEDING
Central Arkansas	———	———	Mid-February
Southern Indiana	———	———	Mid-February
Columbia, Missouri	Jan. 16	April 10	February
Lawrence, Kansas*	Feb. 27	April 22	Late February
Iowa City, Iowa†	———	July 3	March 20
Madison, Wisconsin	March 20	July 4	Late March

*From Scheffer (1909). †From Arlton (1936).

and reproductive tract. This fact and the restricted breeding season indicate that usually only one litter is produced. A single possible exception is a female in an early post-implantation stage of pregnancy taken July 4, 1937 in Dane County, Wisconsin, by P. L. Wright. This animal was trapped in the same tunnel as were two immature and one adult male *Scalopus*. The extremely late date of this pregnancy and the presence of young in the burrow suggests this might be a second pregnancy. No corpora albicantia were seen in the ovaries, however, and the ovarian and uterine morphology suggested that this was a first pregnancy. Unfortunately no mammary tissue was preserved. Whether or not this is an example of second pregnancy in the same year is uncertain, but it is evident that it is an unusual case. The majority of animals clearly do not breed more than once each spring.

Estrus and breeding.—The vagina remains sealed until follicles with antra appear in the ovary, at which time the vagina opens in both virgin and parous animals. Throughout estrus the vaginal orifice appears very white and avascular. In contradistinction the lips of the vagina became reddish after ovulation. The rather large proportion of specimens taken in estrus suggests that ovulation is induced. Further support of this hypothesis is the fact that all females which had ovulated were pregnant. No direct information about the length of gestation was obtained. Data from the Wisconsin sample suggest that gestation is about four weeks or less since maximum breeding appears to occur in late March and early April and the majority of births occur in the latter half of April.

Number of young per litter and embryo mortality.—The average number of embryos in 33 post-implantation specimens was 3.91 (7 specimens with three embryos; 22 with four; and 4 with five embryos). The average number of corpora lutea in 15 specimens was 4.33 (range 3 to 7). These data suggest that there is some embryo loss. Direct evidence for this was noted in one of the 10 pregnant animals for which both corpora lutea and embryo counts are available (Table 3). Also one or more resorbing embryos were noted in four of the 33

TABLE 3.—*Corpora lutea and embryo distribution; the total number of corpora or embryos is given followed by the number in the right and left sides of the tract respectively in parentheses*

SPECIMEN NO.	NUMBER OF CORPORA LUTEA	NUMBER OF EMBRYOS
533 Wisc.	4 (4–0)	4 (2–2)*
569 Wisc.	4 (1–3)	4 (2–2)*
539 Wisc.	5 (2–3)	5 (3–2)*
540 Wisc.	4 (3–1)	4 (3–1)
551 Wisc.	4 (1–3)	4 (1–3)
1027 Mo.	3 (2–1)	3 (2–1)
1029 Mo.	5 (2–3)	5 (2–3)
1030 Mo.	6 (0–6)	5 (2–3)*
1033 Mo.	4 (2–2)	4 (2–2)
1037 Mo.	4 (2–2)	4 (2–2)

*Denotes transmigration of blastocysts.

pregnant specimens. Table 3 shows that transmigration of blastocysts occurred in at least four of the 10 specimens from which data are available. Presumably transmigration is internal since the ovary of *Scalopus* is almost completely enclosed by a bursa. The uterine cornua join before entering the cervix, thus no barrier to internal transmigration exists.

THE MALE REPRODUCTIVE CYCLE

Weight of testes.—Data on the weight of both testes from the Wisconsin, Missouri and Arkansas specimens are available; however, material from all months of the year was obtained only in Missouri. Figure 1 shows that in the Missouri sample the testes of immature animals increased in weight until June, then remained at about the same level (150 to 200 mg.) until early November. Between the end of November and late December or early January the testes increased greatly in size (1000 to 2000 mg.). Weights began to decrease immediately so that by mid-February and March the average weight was less than 1000 mg. Regression in weight was completed by mid-July when testes weighed under 400 mg. Weights remained between 200 and 400 mg. until late November when recrudescence occurred.

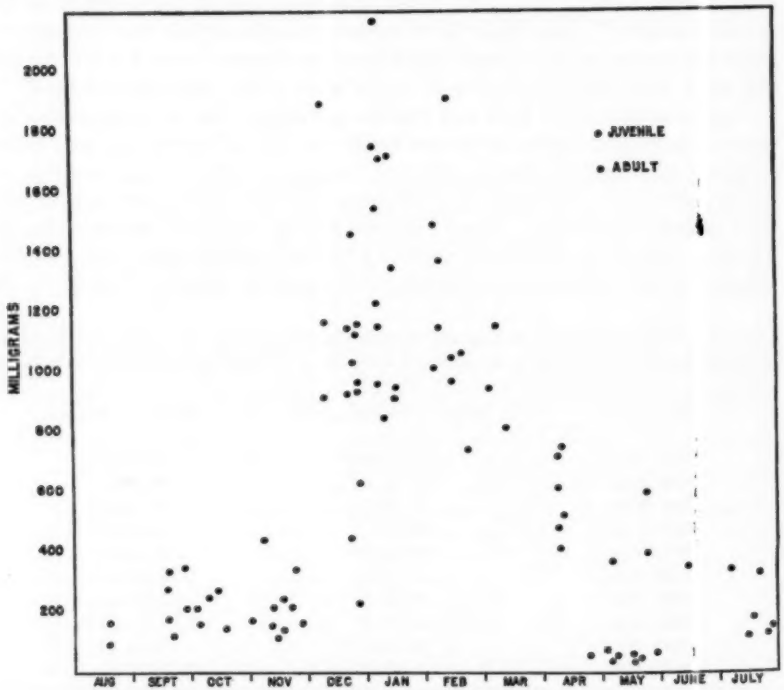

FIG. 1.—Weights of both testes of Missouri *Scalopus*.

Specimens from Wisconsin were not collected between mid-December and March 20. The data available are summarized in Fig. 2. Weights of testes from juvenile males remained under 170 mg. through mid-December. Testes weights were highest (600 to 1200 mg.) in adults taken in late March and early April. By mid-June weights had dropped to under 200 mg. and remained at this level through November.

Comparisons of testis weight data from the Wisconsin and Missouri populations show some interesting differences. The testes of Wisconsin juvenile animals from July through November weighed less than comparable Missouri specimens. Similarly the regressed testes of adult Wisconsin animals in the same period were about half the weight of testes from Missouri specimens. Recrudescence apparently begins at least several weeks later in Wisconsin. Testes of two mid-December juvenile specimens were similar to Missouri specimens from early October and November, while the testes of a single December adult were slightly heavier than those of Missouri fall adult animals. Testis weights of Missouri specimens taken in mid-December were about three times the fall weights.

The period of maximum breeding activity in Missouri has been indicated to be late February and early March. Testes taken from animals in this period averaged about 950 mg. in weight. This is approximately half the peak weights of 1500 to 2200 mg. recorded from many animals taken in late December and early January. Animals from this period were not available from the Wisconsin population. Probably the testis cycle is essentially similar, however, since the data available through the breeding season suggest a constant regression in weight like that found in Missouri specimens.

The consistently lower testes weights found in the Wisconsin population

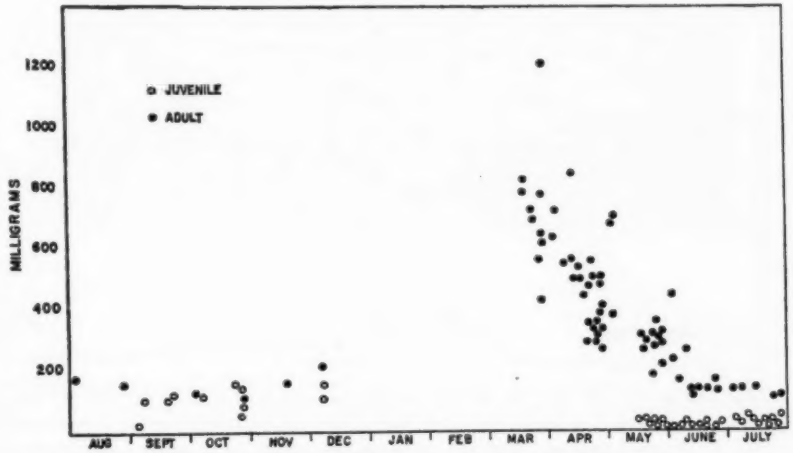

FIG. 2.—Weights of both testes of Wisconsin *Scalopus*.

are not a function of body weight differences in the two populations. Jackson (1915) remarked that the Missouri race *S. a. machrinoides* is smaller than the Wisconsin form *S. a. machrinus*. Analysis of weight variation by season and age shows that comparable classes in the two populations are remarkably similar in weight. Body weights are discussed in detail in a later section.

Histology of testes.—Infantile testes occur in *Scalopus* from the time young animals appear in the population during the spring until late fall. Throughout this period testis tubules are small and undergo little change in size or cellular composition. They resemble infantile testes of sciurids (Kirkpatrick, 1955) and other mammals.

Profound changes occur in the interstitial cells during this period. These cells are very abundant in the first young animals taken in late spring. At this time, however, the cells are small and have very little cytoplasm (Plate IA). They appear as densely packed nuclei when seen under low powers. Later in the season there is a rapid and marked change in appearance. The amount of cytoplasm greatly increases, becoming homogenous and intensely stained. Within a month the diameter of the cells increases from 5 to 15 micra (Plate IB). During the remainder of the infantile period there is some increase in diameter of interstitial cells and the cytoplasm becomes increasingly dense.

Some differences between the cycle in infantile testes of the Missouri and Wisconsin population are noticeable. The period of rapid enlargement of interstitial cells occurs during July in Missouri and during September in Wisconsin. In both populations it appears that the weight increase of testes noted

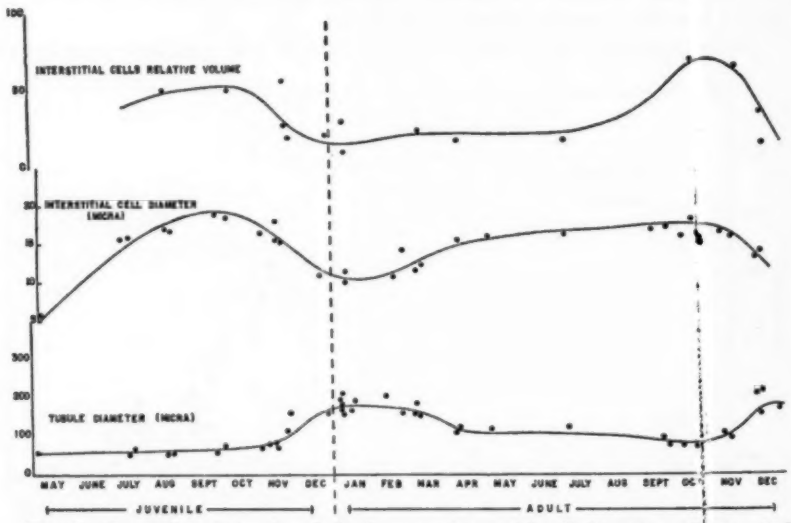
INTERSTITIAL CELLS RELATIVE VOLUME
INTERSTITIAL CELL DIAMETER (MICRA)
TUBULE DIAMETER (MICRA)
MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
JUVENILE
ADULT

FIG. 3. Seasonal variation in tubule diameter, interstitial cell diameter and interstitial cell volume of Missouri *Scalopus*.

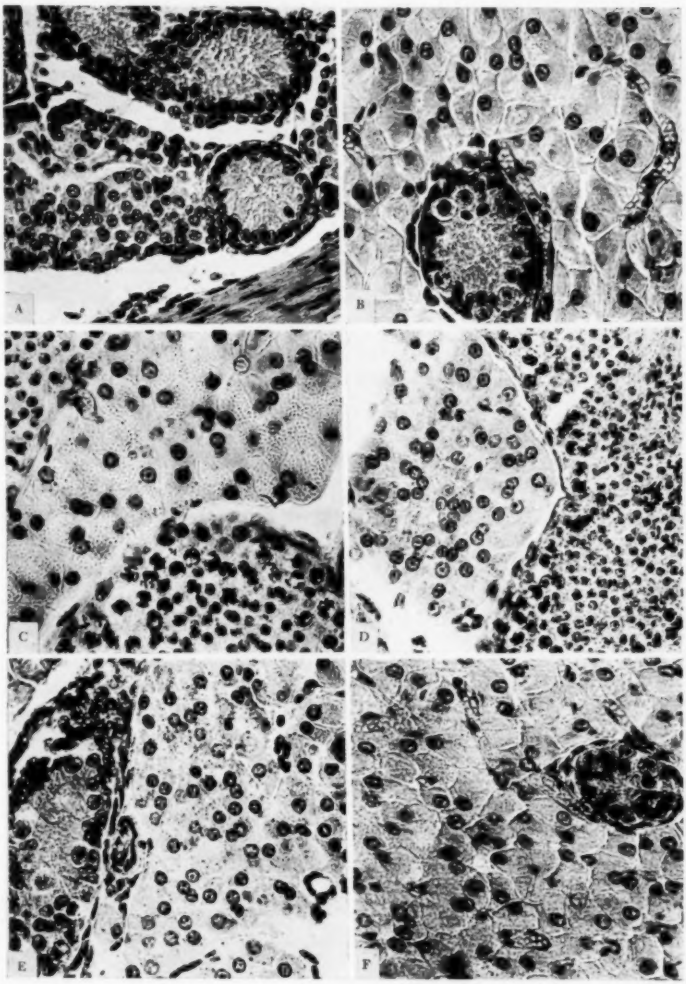

PLATE I

A: Wisconsin juvenile, 16 July; the interstitial cells are small and embryonic. B: Wisconsin juvenile, 22 October; the interstitial cells are maximal in size while the tubules remain infantile. C: Wisconsin adult, 5 April; early active stage; the interstitial cells show the characteristic vacuolation seen in early spermatogenesis. D: Wisconsin adult, 25 April; late active stage; the interstitial cells are small and cell membranes are indistinct. E: Wisconsin adult, 26 July; early regressed stage; spermatogenesis has ceased; the interstitial cells are becoming larger and cell membranes are seen; pigment is abundant. F: Wisconsin adult, 8 October; regressed stage; tubule regression is completed; the interstitial cells are enlarged and comparable to those of fall juvenile testes. All × 610.

at these times is entirely a reflection of interstitial cell growth since the tubules remain unchanged.

A brief stage which may be called prepubertal follows the infantile period. The prepubertal period is here considered as beginning with rapid tubule enlargement and terminating when sperm appears. During this period the tubules are characteristic of other mammals in similar stages and show no unique features.

While the seminiferous tubules are rapidly enlarging the interstitial tissue is becoming much less conspicuous. Much of this is only an apparent reduction due to proportional changes in tubule size. There appears to be, however, an absolute decrease in interstitial cell volume (Fig. 3) when the proportional volume is computed by Pearson's (1952) method. Certainly the size and appearance of these cells change during this period. Their diameters decrease by one-third and their cytoplasm becomes less intensely stained and more vacuolated, suggesting an increase in lipid content.

Prepubertal stages are found from the middle of November to the middle of December in Missouri. The onset of reproductive activity probably occurs about one month later in Wisconsin. The only prepubertal specimen from that area is one of two animals taken December 15. This specimen is very early prepubertal while the second specimen is still infantile.

Testes which are producing sperm are classed as active. Included in this group are testes from young animals in their first breeding season as well as older animals. Testes which show regressive changes but are still producing sperm are also classified in this group. The seminiferous tubules during this stage are typical of other seasonal breeding mammals. They are in active spermatogenesis for a period of two or three months and then begin to show characteristic degenerative changes although sperm are produced for several more months.

Changes in the interstitial cells which were noted in the prepubertal period become more marked in the active testis. Cells have a foamy, vacuolated cytoplasm (Plate Ic). Nuclei are variable in appearance. Some are smaller and darker staining than those of the previous period. These characteristics become more apparent as the breeding season approaches. At this time scattered pigment granules appear in many cells. During the latter part of the active period, when degenerative changes are seen in the tubules, the interstitial cells enlarge slightly and some begin to lose their foamy appearance (Plate Io). This presages a return to a condition similar to that of fall juvenile animals.

The month when spermatogenesis begins in Wisconsin is not known although presumably it would be in January. The first Missouri specimens with sperm in the testes were taken in late December. Sperm have disappeared from the tubules of Wisconsin animals by the first of June. Very few adult males from the summer were collected in Missouri; therefore, information about regression is incomplete. Specimens taken on July 4 and 24 were still producing sperm while late September specimens were fully regressed.

Regressed testes are those which have produced sperm at some time but were inactive at the time they were collected. Tubules of such animals may regress to a condition approximating that of infantile testes. Such completely regressed testes are difficult to separate from infantile stages. The tunica albuginea is thicker and connective tissue within the testis is more abundant than in infantile testes. The sexual accessories, however, provide a more certain basis for separation.

The interstitial cells continue the enlargement noted in the latter part of the active period (Plate IE). By midsummer they have acquired a homogenous cytoplasm and are indistinguishable from interstitial cells of infantile testes (Plate IF).

The extent and season of regression vary in the two populations studied. Regressed testes are found from June until at least mid-December in Wisconsin. Regression probably occurs in August in Missouri although no specimens from this month are available. Specimens taken in late September through October are regressed. The seminiferous tubules of these specimens are about 1½ times the diameter of infantile testis tubules in contrast to those of regressed Wisconsin specimens which are of the same diameter as infantile tubules. Thus it seems that regression occurs later and is not as profound in the Missouri population.

Redeveloping testes could not be differentiated from prepubertal testes on the basis of histological features. Redevelopment may occur slightly earlier in the season than puberty but the evidence is not conclusive. Testes from Missouri animals were redeveloping during November and early December. The only Wisconsin specimen in this stage was from mid-December.

Sexual accessories.—Only the prostate and tail of the epididymis were considered in this study. The activity cycle of these organs in *Scalopus* follows very closely that in the testis tubule and is typical of many mammals.

During the autumn the prostate glands of both infantile and regressed animals are minimally developed. The prostate of regressed adults is, however, approximately double the weight of infantile prostate glands (Fig. 4). Histologically, the glands of these two classes can be distinguished with ease since connective tissue is much more abundant in the regressed prostate. In late fall, when primary spermatocytes appear in the testes, the prostates begin to enlarge. They are maximally developed by the end of December or January. The glands remain fully developed through the active stage of the testis and then begin to regress.

The cycle of the tail of the epididymis is similar to that of the prostate. Sperm transport to the tail is apparently quite rapid since late December specimens from Missouri which show sperm in the testis tubules also have sperm in the epididymis, with one exception. Data from the Wisconsin sample indicated that sperm are retained in the epididymis for about two weeks after cessation of spermatogenesis.

Body weight.—Data relative to body weights are summarized in Table 4. There is no significant difference between means of comparable groups of animals in the Wisconsin and Missouri populations. Data from the Missouri population suggest that the adults have a maximal body weight during the December to February interval. When this category is tested against all other Missouri adults, however, the difference is not significant. Stein (1950) noted that in *Talpa* maximum weights occur in November and May while minimum weights are in December to February. He suggests this is related to food supply.

DISCUSSION

The female reproductive cycle of *Scalopus* resembles the reproductive cycle of other talpids which have been studied. One litter per year born during the spring appears to be the common condition in *Talpa* (Godfrey, 1956), *Desmana* (Krasovsky, 1954), *Condylura* (Eadie and Hamilton, 1956), *Parascalops* (Eadie, 1939), and *Scapanus* (Scheffer, 1922) as well as in *Scalopus*. Litter

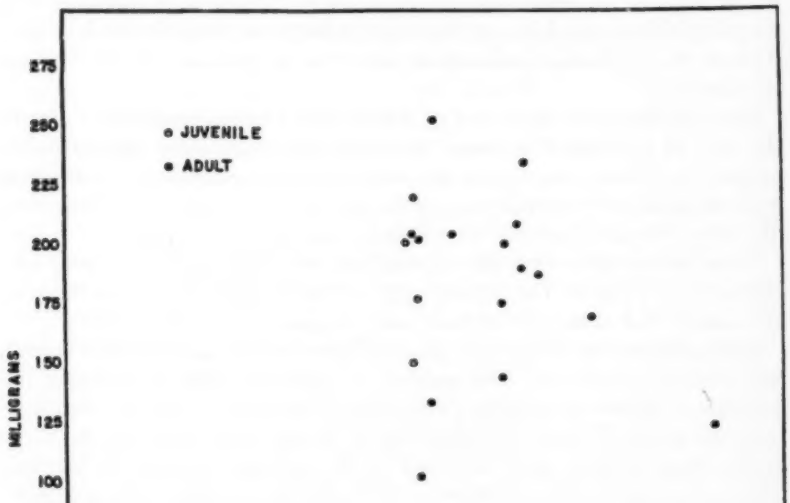

FIG. 4. Prostate weights of Missouri *Scalopus*.

TABLE 4.—*Body weights of male Scalopus, in grams*

CATEGORY	MONTHS	*N*	$\bar{x}$	*s*
Wisconsin:				
Adult	Mar.–Apr.	34	121.5	11.35
Adult	May–July	27	120.6	14.10
Adult	Aug.–Nov.	6	117.6	5.15
Juv.	May–July	28	95.7	8.75
Juv.	Aug.–Nov.	10	107.8	10.79
Missouri:				
Adult	Mar.–Apr.	6	119.0	12.81
Adult	May–July	5	119.8	7.36
Adult	Aug.–Nov.	5	116.6	8.79
Adult	Dec.–Feb.	20	125.1	12.70
Juv.	May–July	8	98.9	11.19
Juv.	Aug.–Nov.	11	113.1	6.69
Juv.	Dec.	5	119.2	10.81

sizes are relatively small, varying between 5.4 for *Condylura* (Eadie and Hamilton, 1956) to two or three for *Desmana* (Krasovsky, 1954). Geographic variation in season of breeding has been reported also for *Talpa* (Godfrey, 1956).

The marked gross variations in the male reproductive tract are similar to those known in many forms having a restricted breeding season. There are, however, several interesting findings when the more detailed aspects of the cycle are considered.

The testis cycle of *Scalopus* differs from that of *Talpa* in the season of onset of spermatogenesis and in the relationship this bears to the breeding season. Although testis enlargement in *Talpa* begins during November or December, development is very slow. The maximum size is not reached until March when breeding occurs (Courrier, 1927). Primary spermatocytes appear in January and sperm are present by the beginning of March. This contrasts sharply with the very rapid enlargement of the testis to maximum size which occurs during December in *Scalopus*. Breeding then occurs several months later after pronounced weight regression. This situation is intermediate between the general mammalian condition in which maximum testis size correlates with breeding and the complete chronological separation of spermatogenesis from copulation which occurs in some bats (Pearson *et al.*, 1952).

Some basic differences in the testis cycles of the Missouri and Wisconsin populations are apparent. The weights of regressed testes of Wisconsin specimens are approximately one-half the weights of comparable Missouri males. This suggests that regression is more profound in the Wisconsin population. Since the maximum testis weights of the Wisconsin population are unknown, however, the weight comparisons of regressed testes alone does not demonstrate greater regression. Certainly spermatogenesis ceases earlier in the Wisconsin population and the tubules regress rather quickly to a diameter equal to that

of juvenile testis tubules. In the Missouri population regression is later and much slower. The tubules never regress to the level of juvenile testis tubules.

Similarly, testes of juvenile Missouri specimens increase in weight during early July while a corresponding weight increase does not occur until September in Wisconsin animals. The difference in time of birth (1 month) is not great enough to account for the weight variation on an age basis alone. Apparently, in both juvenile and adult Missouri males, a higher level of testis development is maintained in the nonbreeding season.

A matter of interest is the role of environmental influence on reproductive cycles in the male. Neither temperature nor light seem reasonable as factors. If decreasing day length were a major factor it would be expected that spermatogenesis would begin earlier in the north. If increasing day length were important, spermatogenesis would not begin until after December. If cool temperatures were stimulating, spermatogenesis would continue over a longer period in Wisconsin. If warm temperatures were stimulating, spermatogenesis would not occur in winter. Since all results are contrary to those expected it appears some other environmental factor may be of importance or that internal rhythms regulate the cycle. Perhaps the cyclic regulation is similar to that of *Tatera* in which internal rhythms seem to be of major importance with food having some regulatory role (Prasad, 1956).

The interstitial cell cycle of *Talpa* has been studied by several workers and conflicting findings have been reported. The often-quoted work of Tandler and Grosz (1912) indicated that the interstitial cell cycle, considering both individual cell size and total tissue volume, was inversely related to the tubule cycle. They found that the cells were more vacuolated in the fall than during the breeding season. Pellegrini (1925), using lipid stains, reported findings completely opposite to those of Tandler and Grosz. He found that during the sexually inactive period the cells were smallest and contained the minimum amount of lipid. During the breeding season the cells were largest and contained the maximum amount of lipids.

Courrier (1927) studied the same problem. He made important criticisms of the work of Tandler and Grosz, pointing out that (1) number and volume of cells should not be considered the only criterion of physiological activity; (2) Tandler and Grosz in no way showed a real increase of interstitial cells during the active phase, since they did not consider gross volume changes of the testis during the cycle. From his own observations, Courrier concluded that there was no distinct cycle in the interstitial cells. He did report that during the late active stage pigment occurred within the interstitial cells as has been noted in *Scalopus*. His general conclusion was that, in comparison to the interstitial cycle of most mammals, "Il en est autrement chez la Taupe, nous avons vu a tout moment de l'annee des cellules interstitielles volumineuses, riches en cytoplasme, renfermant des enclaves lipoidigues osmiophiles labiles."

The evidence from this study suggests that there is a real cycle in the interstitial cells of *Scalopus*. They are largest during the period of sexual

inactivity. The absolute volume also seems to be greatest then, although the method used to estimate total volume is somewhat crude. It also seems possible that different fixatives and techniques may affect the interpretation of cell size. The interstitial cells also appear less vacuolated and therefore presumably have less lipid during the inactive phase, as was also reported by Pellegrini (1925) in *Talpa*. Pearson and co-workers (1952) studied the interstitial cell cycle of *Corynorhinus* and found that in this species the cycle was essentially similar to that reported here. Although in *Corynorhinus* the chronological separation of spermatogenesis and accessory growth introduces further complication, the relationship between interstitial cell size and volume and size of sexual accessories is inverse, just as in *Scalopus*. The interstitial cell cycle of *Scalopus* does not suggest in any way that these cells are not responsible for maintenance of the accessories, but it is apparent that experimental work is needed to clarify the physiology of this cycle. Perhaps the enlarged interstitial cells of the sexually inactive testis represent a storage phase of some androgen precursor as Pearson suggests. It also may be that they are elaborating an unknown product.

SUMMARY

The breeding season of *Scalopus* is restricted to three or four months during the spring. The peak of breeding occurs in February in central Missouri and during late March at Madison, Wisconsin. Only one litter is produced each year. The average litter size is 3.91 with the most frequent number being four. Female *Scalopus* breed when one year old.

The testes of young *Scalopus* remain in the juvenile condition until late November in Missouri. At that time a rapid weight increase begins. Spermatogenesis begins during December and sperm have reached the epididymis by the end of December. Maximum testis weights occur during early January. Testes have regressed to about one-half maximum size when copulation occurs. Regression continues during the spring and summer. Sperm production ceases in July and the testes remain regressed until recrudescence begins in November. Seasonal and anatomical variations are noted when the testis cycle of Wisconsin *Scalopus* is compared with that in the Missouri population.

The interstitial cells of the testis are of maximum size and volume in juvenile animals during the fall. At that time the seminiferous tubules and sexual accessories are minimally developed. With the onset of spermatogenesis, the volume and size of the interstitial cells decrease and they appear vacuolated. When spermatogenesis ceases the interstitial cells again increase in size.

LITERATURE CITED

Arlton, A. V. 1936. An ecological study of the mole. Jour. Mamm., 17: 349–371.

Courrier, R. 1927. Étude sur le determinisme des characteres sexuels secondaires chez quelques mammiferes á activite testiculaire periodique. Archiv. Biol., 37: 175–334.

Eadie, W. R. 1939. A contribution to the biology of *Parascalops breweri*. Jour. Mamm., 20: 150–173.

——— and W. J. Hamilton, Jr. 1956. Notes on reproduction in the starnosed mole. Jour. Mamm., 37: 223–231.

Godfrey, G. K. 1956. Reproduction of *Talpa europaea* in Suffolk. Jour. Mamm., 37: 438–440.

HAMILTON, W. J., JR. 1943. The mammals of eastern United States. Comstock Publishing Co., Ithaca, N.Y. 432pp.

JACKSON, H. H. T. 1915. A review of the American moles. N. Amer. Fauna, 38: 99 pp.

KIRKPATRICK, C. M. 1955. The testis of the fox squirrel in relation to age and seasons. Amer. Jour. Anat., 97: 229–256.

KRASOVSKY, V. P. 1954. Observation on reproduction of the desman. Zool. Jour., 33: 180–183. (Translated by S. Subtelney.)

PEARSON, O. P., M. P. KOFORD AND A. L. PEARSON. 1952. Reproduction of the lump-nosed bat (*Corynorhinus rafinesquii*) in California. Jour. Mamm., 33: 272–320.

PELLEGRINI, G. 1925. Sulle modificazioni degli elementi interstiziali del testicolo negli animali ad attivita sessuale periodica. Arch. Ital. Anat. Emb., 22: 550–585.

PRASAD, M. R. W. 1956. Reproductive cycle of the male Indian gerbille (*Tatera indica cuvierii* Waterhouse). Acta Zool., 37: 87–122.

SCHEFFER, T. H. 1909. Investigation of the mole. Trans. Kansas Acad. Sci., 23: 119–131.

———. 1922. American moles as agricultural pests and as fur producers. U.S.D.A. Bull. 1247.

STEIN, G. H. W. 1950. Zur Biologie des Maulwurfs, *Talpa europaea* L. Bonner Zool. Beiträge, 1: 97–116.

TANDLER, J. AND S. GROSZ. 1912. Uber den Saisondimorphismus des Maulwurfhodens. Arch. Entwicklungsmechanik der Organismen, 33: 295–302.

Dept. of Zoology, Univ. of Missouri, Columbia. Received September 18, 1957.

BATS OF THE GENUS *MYOTIS* FROM OKLAHOMA

BY BRYAN P. GLASS AND CLAUD M. WARD

Prior to the present study only four species of the genus *Myotis* had been recorded from Oklahoma, of which only two were known from more than one locality. Only a few of the caves that harbor bats had been mentioned in the literature. For the convenience of other workers a list of Oklahoma caves from which bats have been taken is presented in this paper. Eight species of *Myotis* now known to occur within the state are discussed below.

Acknowledgments are due to the Oklahoma State Department of Health for providing a truck for use in the field, to W. W. Dalquest, E. Raymond Hall and J. Knox Jones for help in verifying identifications, and to Charles O. Handley of the U.S. National Museum, George H. Lowery, Jr. of Louisiana State University, William H. Burt, University of Michigan, and H. B. Sherman of DeLand, Florida, for the loan of specimens.

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The genus *Myotis* was first reported as occurring in Oklahoma by Howard Cross (1917) who listed *M. sublatus* [*sic*] and *M. lucifugus* in a semipopular

bulletin prepared for the Oklahoma Geological Survey. The species were listed without reference either to existing specimens or to localities. Other species of mammals listed in this publication are so obviously in error that the validity of the entire list is open to question. Miller and Allen (1928) listed three specimens of *M. velifer incautus* from Fort Reno. Blair (1939) gave locality records for three species, two of which (*M. subulatus melanorhinus* and *M. grisescens*) were new records for the state. Glass (1951) reported collecting *M. s. melanorhinus* from Cimarron County, but the identification was in error, and the specimens are herein designated as *M. yumanensis yumanensis. M. sodalis* was reported by Glass (1955) from Adair County. These are the only published records for bats of this genus from the state.

During the survey of which this is a partial report, 41 caves were examined in various parts of the state. One or more species of *Myotis* was found in 26 of them. They are listed below by established name, where such exists, or by the name either of the landowner or of some appropriate feature of local topography. For each the approximate legal description is included. All are described with reference to the Indian Meridian except two in Cimarron County, which are referred from the Cimarron Meridian which separates Oklahoma from New Mexico.

ADAIR BAT CAVE: Sec. 7, T. 11 N, R. 24 E of I.M., 5 miles S of Little Kansas, Adair County.

ALABASTER CAVERNS: Sec. 33, T. 26 N, R. 18 W of I.M., 5 miles S, 2 miles W of Freedom, Woodward County. (Includes also Owl Cave.)

ANDERSON CREEK CAVES: Sec. 17, T. 27 N, R. 17 W of I.M., 3 miles E of Camp Houston, Woods County; two caves.

BLACK HOLLOW CAVE: Sec. 20, T. 22 N, R. 22 E of I.M., 1 mile E of Spavinaw Hills Park, Delaware County.

BOWEN'S TRAIL CAVE: Sec. 17, T. 1 N, R. 22 E of I.M., 4.5 miles NW of Honobia, Pushmataha County.

BOY SCOUT CAVE: Sec. 33, T. 26 N, R. 24 E of I.M., 3 miles E, 6.5 miles N of Grove, Ottawa County.

CAVE SPRINGS CAVE: Sec. 34, T. 15 N, R. 24 E of I.M., 1 mile E, 3.5 miles N of Bunch, Adair County.

COCHRAN'S TROUT CAVE: Sec. 3, T. 22 N, R. 25 E of I.M., 5 miles E of Sycamore, Delaware County.

CONNER'S CAVE: Sec. 30, T. 22 N, R. 15 W of I.M., 5 miles S, 2 miles E of junction of U.S. Highway 281 and State Highway 15, Major County.

CORN CAVES: Sec. 5, T. 11 N, R. 15 W of I.M., 5.5 miles N, 2 miles W of Corn, Washita County; three caves.

CRYSTAL CAVE: Sec. 31, T. 14 N, R. 24 E of I.M., 3 miles S, 2 miles W of Bunch, Adair County.

DUNAWAY CAVE (Twin Caves): Sec. 13, T. 23 N, R. 22 E of I.M., 5 miles W, 3.5 miles N of Jay, Delaware County.

DUNCAN CAVE: Sec. 8, T. 20 N, R. 25 E of I.M., 2 miles S, 1.5 miles E of Colcord, Delaware County.

FLOWER CREEK CAVE: Sec. 20, T. 16 N, R. 20 E of I.M., 3 miles E, 3 miles N of Ft. Gibson, Cherokee County.

GRIEVER CREEK CAVE: Sec. 30, T. 22 N, R. 15 W of I.M., 3 miles E, 4 miles S of Junction of U.S. Highway 281 and State Highway 15, Major County.

Half-Moon Cave: Sec. 27, T. 18 N, R. 21 E of I.M., 0.5 mile W of Gideon on Fourteen-Mile Creek, Cherokee County.

Icebox Cave: Sec. 33, T. 26 N, R. 19 W of I.M., 6 miles S, 7.5 miles W of Freedom, Woodward County.

Iron Door Cave: Sec. 19, T. 22 N, R. 22 E of I.M., 0.5 mile E of Spavinaw Hills State Park, Delaware County.

Jester Cave: Sec. 35, T. 19 N, R. 24 W of I.M., 3 miles N of Jester, Greer County.

Kiamichi Mountain Cave: Sec. 27, T. 2 N, R. 24 E of I.M., 3.5 miles S of Muse, LeFlore County.

Longhorn Mountain Cave: Sec. 2, T. 5 N, R. 15 W of I.M., 3 miles S, 0.5 mile E of Sedan, Kiowa County.

Merrihew Cave (Marehew Cave): Sec. 17, T. 29 N, R. 17 W of I.M., 13 miles N, 3 miles E of Camp Houston, Woods County.

Mystic Cave: Sec. 18, T. 2 S, R. 3 E of I.M., 10 miles S, 1.5 miles E of Sulphur, Murray County.

Pigeon Cave: Sec. 11, T. 5 N, R. 1 E of C.M., 3 miles E, 1 mile N of Kenton, Cimarron County.

Radziminski Mountain Cave: Sec. 22, T. 3 N, R. 17 W of I.M., 0.5 mile N, 1.5 miles W of Mountain Park, Kiowa County.

Reed Caves: Secs. 28 and 29, T. 15 N, R. 24 W of I.M., 2 miles W, 1.5 miles S of Reed, Greer and Harmon Counties; two caves.

Selman's Cave: Sec. 33, T. 26 N, R. 19 W of I.M., 4 miles S, 7 miles W of Freedom, Woodward County.

Sutherland Caves: Sec. 10, T. 22 N, R. 25 E of I.M., 5.5 miles E of Sycamore, Delaware County; two caves.

Spavinaw Creek Cave: Sec. 15, T. 22 N, R. 22 E of I.M., 0.5 mile downstream from Upper Spavinaw Dam, Delaware County.

Stansbury's Cave: Sec. 11, T. 21 N, R. 24 E of I.M., 7 miles S, 4.5 miles E of Jay, Delaware County.

Tesequite Cave (Texequite Cave): Sec. 35, T. 5 N, R. 1 E of C.M., 2 miles E, 3 miles S of Kenton, Cimarron County.

Vickery Caves: Sec. 5, T. 22 N, R. 16 W of I.M., 2.5 miles W of junction of U.S. Highway 281 and State Highway 15, Major County; two caves.

Windmill Cave: Sec. 25, T. 5 N, R. 14 W of I.M., 15.5 miles S, 1.5 miles W of Carnegie, Kiowa County.

Wooden Door Cave: Sec. 21, T. 22 N, R. 14 W of I.M., 2.5 miles N of Topsy, Delaware County.

In the species accounts the following abbreviations are used: USNM—U.S. National Museum; UMMZ—University of Michigan Museum of Zoology; OAM—Oklahoma State University Museum of Zoology; KU—University of Kansas Museum of Natural History. Measurements (average and extremes) are given in millimeters.

Myotis lucifugus lucifugus (LeConte)

This species was reported for the state by Cross (*loc. cit.*). The first verifiable record was established when a specimen was found hanging alone on a cellar wall of the cafe building at Beaver's Bend State Park on August 19, 1954. In the summer of 1955 a series of 16, together with a few *Eptesicus fuscus*, were taken from interstices behind the corner boards of several cabins in the youth camp area of the park. None of these bats have been taken in the state outside of this vicinity.

Description.—Measurements of 16 specimens from McCurtain County: Total length 87.6 (83–92); tail 38.4 (36–44); hind foot 10.1 (10–11); ear 14.4 (13–16); tragus 7.6 (7–9); forearm 36.0 (33.9–37.1); condylobasal length 13.62 (13.40–13.81); maxillary tooth row

5.21 (5.09–5.37). The pelage is exceptionally long and lax with long glossy tips of brown. Oklahoma specimens have whitish tips to the hairs below.

Oklahoma records.—McCurtain County, Beaver's Bend State Park (OAM).

Remarks.—The skins of *M. lucifugus* taken in Oklahoma agree with Miller and Allen's (1928) description of the form found west of the Mississippi. The color above is a glossy olive-brown, having a bronzed appearance. The tips of the hairs below are whitish, differing in this respect from the buffy color found in specimens from the Northeast. Specimens from Missouri agreed with the Oklahoma specimens, but due to discoloration on the underside exact comparisons could not be made. No cranial distinctions were detected in the Oklahoma specimens.

Myotis yumanensis yumanensis (H. Allen)

In 1949 Glass and party collected a series of these bats in Cimarron County. A number were found in Tesequite Cave, and other specimens were shot on North Carizzo Creek. They were erroneously assumed to be *M. subulatus melanorhinus* (Glass, 1949). In June, 1955, Ward secured seven pregnant females from Tesequite Cave. Each was carrying a single well-developed fetus. Since 1955 the species has been collected in the vicinity of Black Mesa in Cimarron County on numerous occasions. A few have been taken in mist nets at Pigeon Cave and many have been shot while flying over the Cimarron River near the mouth of North Carizzo Creek. Tesequite Cave seems to be occupied by a colony of these bats throughout the summer.

Description.—Measurements of 21 adults from Cimarron County: Total length 84.3 (78–89); tail 36.9 (34–40); hind foot 9.2 (8–10); ear 13.9 (12–15); tragus 8.0 (7–9); forearm 34.3 (32.3–35.4); condylobasal length 13.23 (12.90–13.55); maxillary tooth row 5.25 (5.05–5.41). In Oklahoma specimens the hair above is tipped with Tawny Olive to Buffy Brown. The hair on the under parts is tipped with Pale Cartridge Buff. The bases of the hairs above and below are Dusky Neutral Gray.

Oklahoma records.—Cimarron County, Tesequite Cave, Pigeon Cave, Cimarron River near mouth of North Carizzo Creek, North Carizzo Creek 6 miles N of Kenton (all OAM).

Remarks.—The behavior of these bats in some respects resembles that described by Rice (1957) for *M. austroriparius*. They do not leave their daytime retreat until darkness is almost complete. Then they fly close to the ground and are rarely silhouetted against the sky. Success in collecting them was achieved by using artificial illumination, a combination of car lights and a portable spotlight that was connected to the electrical circuit of the vehicle. The vehicle was parked so that the lights would shine across the shallow river channel and illuminate the bats as they flew by close to the surface of the water. The spotlight was then used to illuminate them long enough for shooting. For this purpose flashlights were ineffective.

The Oklahoma specimens have been assigned with some hesitancy to the subspecies *yumanensis*. A considerable color variation exists between the skins from Oklahoma and those examined from Rice, Arizona. Not only are the Oklahoma skins darker, but the fur is slightly longer. One skin from Clayton, New Mexico, listed as atypical by Miller and Allen (*loc. cit.*), resembles the Oklahoma specimens both in size and color. The average total length of eight specimens from Texas and Arizona is 78.55 mm. as compared to 82.7 mm. for twelve specimens from Oklahoma. These data suggest the need for a review of the species *yumanensis*.

Myotis austroriparius gatesi Lowery

This form has been reported from only two localities, both in Louisiana, although a related form, *M. a. mumfordi*, has been reported from Arkansas (Sealander, 1956). In August, 1955, two bats of this subspecies were shot when it was almost too dark to see, while they were flying about a foot above the water of the Mountain Fork River 8 miles E of

Smithville in McCurtain County. No other specimens were taken during that year but in March, 1956, a single individual was taken in a mist net hung over the water in the same locality. In June, 1956, a single specimen was shot at the bridge over the Little River at Honobia, LeFlore County, using a spotlight in the manner previously described for collecting *M. yumanensis*.

Description.—Measurements of 5 specimens from McCurtain County: Total length 89.6 (87–95); tail 38.6 (37–41); hind foot 11; ear 14.2 (14–15); tragus 8 (7–9); forearm 37.6 (37.2–38.3); condylobasal length 13.81 (13.61–14.00); maxillary tooth row 5.35 (5.30–5.40). The dorsal hair is tipped with Amber Brown to Cinnamon Brown, and the ventral hair is tipped with either Buff-Yellow or Ferruginous. The hair is thick and woolly, standing out from the body. In the specimens examined the wing membrane was attached at the ankle, but the point of attachment was found to vary more than in the *M. grisescens* with which they were compared. The brain case is large and expanded in comparison with other species of *Myotis* and the sagittal crest is low but distinct in adults.

Oklahoma records.—LeFlore County, Honobia; McCurtain County, 8 miles SE of Eagletown, 8 miles E of Smithville, 9 miles N of Wright City (all OAM).

Remarks.—Because of its low, rapid and stable flight this bat is easily distinguished from others with which it may be seen. Its buffy body color reflects light, thus enhancing its recognition even at considerable distances. In August, 1956, it was recognized flying over the Little River east of Nashoba in Pushmataha County, and on Glover River, near both Battiest and Glover, in McCurtain County. In September, 1956, a series of eight was collected on Little River 8 miles SE of Eagletown, McCurtain County. The species has not been seen on either the Red or Kiamichi rivers which in Oklahoma encircle the Little River basin on the north, west and south.

The first two specimens collected were in molting pelage and had a bright orange wash below and on the foreparts above. An adult collected on Glover Creek north of Wright City on August 2, 1957, was uniformly orange above and below, except on the flanks. The color does not appear on any of the other Oklahoma specimens, but is found on the under side only on some specimens from Louisiana. Juvenile or subadult specimens taken in late summer were dull grayish-brown in color.

Myotis grisescens Howell

Although common in the caves of the Ozark district, it was not until 1939 that the occurrence of this species in Oklahoma was established. Blair (1939) noted two localities in Adair and Cherokee counties where the species had been collected. Since 1954, *grisescens* has been taken in several caves, all within the Ozark biotic district. The species is gregarious, being the only one in northeastern Oklahoma that gathers together in large aggregations. For this reason large guano piles in caves are strong presumptive evidence of the presence of this species, even without the bats themselves being seen. Adair Cave is perhaps the most widely known cave in northeastern Oklahoma, and its colony of *grisescens* has provided specimens for numerous collections. While Dunaway Cave has yet to yield actual specimens, it does contain two large guano piles and undoubtedly harbors a large colony of this species. Gray bats, apparently, usually return to the home cave after foraging flights, for mist nets will capture them in large numbers both entering and leaving at all hours of the night, but nets set before caves that do not harbor a colony only rarely take them. These bats apparently do not concentrate over streams while feeding, and they are rarely shot.

Description.—Measurements of 26 specimens from northeastern Oklahoma: Total length 102.5 (92–112); tail 41.7 (34–47); hind foot 11 (9–12); ear 15.5 (15–16); tragus 9.1 (8–10); forearm 42.2 (40.4–44.2); condylobasal length 14.88 (14.60–15.20); maxillary tooth row 5.93 (5.80–6.04). This bat is found in two color phases, either Dark Mouse Gray above and whitish below, or Cinnamon Brown above and pale buff below. The hair above is uniformly colored to the base; below it is Dark Mouse Gray at the base. The wing membrane

is attached at the ankle. Skulls of adults have a distinct sagittal crest.

Oklahoma records.—Adair County, Adair Cave 5 miles S of Little Kansas (OAM, UMMZ); Cherokee County, Scraper (UMMZ), Half-moon Cave (OAM), Cave Springs Cave (OAM); Delaware County, Stansbury's Cave (OAM), Spavinaw Creek Cave (OAM); Muskogee County, Flower Creek Cave (OAM); Ottawa County, Boy Scout Cave (OAM).

Remarks.—In 1950 and 1951 these bats in Adair Cave were observed to be bearing young approximately June 15. Of the numerous pregnant females examined none were found to be carrying more than a single fetus. Individuals in the gray pelage were noted mainly in late July, which may indicate that gray animals are juveniles, or that July is the molting season.

Myotis velifer incautus (J. A. Allen)

This species is the most widespread member of the genus in Oklahoma, being found in most of the western third of the state, exclusive of the Panhandle. Usually it is to be found in gypsum caves where it often occurs in large aggregations. Both hibernating and breeding populations are known, and the species frequently occupies the same cave throughout the year. In forming large clusters *M. velifer* resembles *M. grisescens*, and large heaps of guano accumulate beneath its habitual roosts. In western Oklahoma, however, these must be distinguished from the deposits made by the Mexican freetail bat, *Tadarida brasiliensis mexicana*, which also ranges throughout western Oklahoma. The latter leaves guano deposits covering hundreds of square feet, frequently many feet in depth, which have a strong and distinctive odor. The guano deposits of the former are more restricted in area, rarely covering an area as much as 50 feet in diameter; while the fresh material may have an odor of ammonia, it never has the pungent smell associated with the freetail.

Blair (1939) listed numerous specimens from collections throughout the United States, but prior to his report the only published record of the species was in Miller and Allen (*loc. cit.*).

Description.—Measurements of 19 adults from northwestern Oklahoma: Total length 106 (97–115); tail 45.6 (41–49); hind foot 11.2 (10–13); ear 16.1 (15–17); tragus 9.7 (9–10); forearm 44.0 (41.1–45.5); condylobasal length 16.12 (15.62–16.59); maxillary tooth row 6.63 (6.45–6.83). This is the largest bat of the genus found in the state. The adult pelage is tipped with Tawny Olive above and Cartridge Buff below. The base of the hair is Slate Color throughout.

Oklahoma records.—Blaine County, Salt Creek Canyon, 4 miles SE of Southard (KU); Canadian County, Fort Reno (Miller and Allen, 1928); Garfield County, Enid (KU); Major County, 12 miles S of Waynoka (OAM), Griever Creek Cave (OAM), Graver [*sic*] Creek 9 miles SW of Togo (KU), Vickery Caves (OAM); Greer County, Jester Cave (OAM); Harmon County, Reed Cave No. 2 (OAM); Woods County, Waynoka (KU), Merrihew Cave (OAM); Washita County, Corn Caves (OAM); Woodward County, 10 miles S of Freedom (UMMZ), Icebox Cave (OAM), Alabaster Caverns (OAM), Mooreland (OAM); Comanche County, Cache Creek (USNM); Harper County, May (OAM).

Remarks.—Females have been noted giving birth to young the last week of June. Flying juveniles and young of a few days have been seen on July 17. Juveniles differ from the adults in having a grayer, more woolly pelage, and have more prominent whitish spots behind the ears.

Myotis keeni septentrionalis (Trouessart)

Although this species has been reported from Arkansas, Missouri and Kansas, it was not known from Oklahoma until July of 1954, when five specimens were taken from Crystal Cave. They were found hanging singly, hidden in narrow crevices and other snug retreats. On September 25 two more were taken from the same cave. Later, in the summer of 1955, specimens were taken in mist nets from four other caves. Two from Adair Cave escaped before they could be preserved.

Description.—Measurements of 19 adults from northeastern Oklahoma: Total length 84.5 (82–90); tail 38.1 (36–42); hind foot 9.1 (8–10); ear 16.5 (15–18); tragus 9.2 (9–12); forearm 33.7 (31.0–35.6); condylobasal length 14.02 (13.46–14.65); maxillary tooth row 5.82 (5.61–6.07). The most distinguishing character of this bat is its long ears, which reach well beyond the snout when laid forward. The hair above has burnished tips of Bright Hazel Brown. Below, the hair is tipped with Buffy Brown. Basally the hair above and below is Fuscous-Black to almost Slate. The skull is rather narrow in proportion to its length.

Oklahoma records.—Adair County, Crystal Cave (OAM), Cave Springs Cave (OAM), Adair Cave; Delaware County, Duncan Cave (OAM); LeFlore County, Kiamichi Mountain Cave (OAM).

Remarks.—All Oklahoma specimens were summer-taken, and all were associated with caves. Although no winter specimens are extant it seems likely that the bats hibernate in the same area where they are active in summer, and have escaped notice because of their secretiveness. The single specimen from the Ouachita biotic district south of the Arkansas River extends the range of the species well into the area where the rocks are predominantly sandstone. Caves are not numerous in this region, and it is doubtful that many records will ever be secured there.

Myotis sodalis Miller and Allen

This species was first reported from the state by Glass (1955). Two specimens were found clustered with a group of hibernating *M. grisescens* in Adair Cave in February, 1952. No additional specimens were taken, in spite of extensive field work, until November, 1955, when a student, Philip Pierce, collected three in Bower's Trail Cave. This cave is in the Ouachita biotic district, while Adair Cave is in the Ozark district.

Description.—Measurements of 4 specimens from eastern Oklahoma: Total length 85.5 (85–86); tail 36.3 (36–37); hind foot 9.3 (9–10); ear 13.6 (13–14); tragus 7.3 (7–8); forearm 38.2 (37.3–39.3); condylobasal length 13.96 (13.40–14.42); maxillary tooth row 5.42 (5.24–5.54). The hair of this bat is fine and fluffy, with three color bands. Basally there is a wide band of Fuscous Black, followed by a narrow gray band, and distally a band of Cinnamon Brown. The bases of the hairs below are Slaty with grayish-white and Cinnamon Brown tips. There is a keel on the calcar.

Oklahoma records.—Adair County, Adair Cave (OAM); Pushmataha County, Bower's Trail Cave (OAM).

Remarks.—Comparisons reveal no significant differences between the Oklahoma specimens and those from Arkansas, Missouri, Tennessee and Kentucky.

Myotis subulatus melanorhinus (Merriam)

The species *subulatus* has been taken in two widely separated areas of the state. Blair (1939) reported a single specimen from 3 miles N of Kenton in Cimarron County. Specimens were collected in the immediate area in 1955, 1956 and 1957. In addition, four were taken in 1955 and one in 1956 from the Wichita Mountains of Comanche, Greer and Kiowa counties.

Description.—Measurements of 4 specimens from the Wichita Mountains: Total length 83.3 (82–87); tail 36.8 (34–39); hind foot 8.3 (8–9); ear 13.3 (13–14); tragus 7.5 (7–8); forearm 31.0 (30.1–32.2); condylobasal length 12.64 (12.39–12.96); maxillary tooth row 4.97 (4.83–5.09). This is the smallest member of the genus in Oklahoma. Its small size, long glossy hair and black face and ears separate it from other species. The hair above is tipped with Ochraceous-Tawny to Dresden Brown, and below, with whitish to light Buckthorn Brown. The basal half of the hair is Slate Black. The calcar is prominently keeled. The dorsal profile of the skull is noticeably flattened when compared to other species of *Myotis*.

Oklahoma records.—Cimarron County, 3 miles N of Kenton (UMMZ, OAM), mouth of North Carizzo Creek (OAM); Comanche County, old mine tunnel in the Narrows, Wichita Mountains Wildlife Refuge (OAM); Greer County, 1 mile N of Granite (OAM); Kiowa County, Windmill Cave (OAM), Radziminski Mountain Cave (OAM).

Remarks.—The specimens taken in Oklahoma have been assigned to the subspecies *melanorhinus* largely on the basis of Blair's record. Blair's specimen was not available for comparison; however, most of the Cimarron County specimens and all of the Wichita Mountain specimens bear as much resemblance to the race *leibi* as they do to *melanorhinus*. One collected in Cimarron County in 1957 compared favorably with bright chestnut-colored *melanorhinus* from Valencia County, New Mexico. Considering the geographical and ecological proximity of Oklahoma to New Mexico, rather than to the northeastern states, the Oklahoma specimens must be considered to belong to the subspecies *melanorhinus*. The recent discovery of *M. s. leibi* in central Missouri (Davis and Lidicker, 1957) keeps open the question of the status of the Oklahoma specimens.

LITERATURE CITED

BLAIR, W. FRANK. 1939. Faunal relationships and geographic distribution of mammals in Oklahoma. Amer. Midl. Nat., 22: 85–133.

CROSS, HOWARD. 1917. Animal life in Oklahoma. Okla. Geol. Survey, Circ. No. 6: 7–36.

DAVIS, WAYNE H. AND WILLIAM Z. LIDICKER, JR. 1955. *Myotis subulatus leibii* in Missouri. Jour. Mamm., 36: 288–289.

DAVIS, WAYNE H., WILLIAM Z. LIDICKER, JR. AND JOHN A. SEALANDER, JR. 1955. *Myotis austroriparius* in Arkansas. Jour. Mamm., 36: 288.

GLASS, BRYAN P. 1951. Report on the mammals of the Black Mesa Region, Oklahoma. Proc. Okla. Acad. Sci. (for 1949), 30: 26–30.

———. 1955. New records for bats in Oklahoma. Jour. Mamm., 36: 128.

MILLER, GERRIT S., JR. AND GLOVER M. ALLEN. 1928. The American bats of the genera *Myotis* and *Pizonyx*. U.S. Nat. Mus., Bull. 205: 1–954.

RICE, DALE W. 1957. Life history and ecology of *Myotis austroriparius* in Florida. Jour. Mamm., 38: 15–32.

SEALANDER, JOHN A., JR. 1956. A provisional check-list and key to the mammals of Arkansas (with annotations). Amer. Midl. Nat., 56: 257–296.

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NOTES ON HIBERNATION AND AWAKENING IN ARCTIC GROUND SQUIRRELS

BY X. J. MUSACCHIA AND RODGER D. HAMILTON[1]

In September, 1949, 32 live ground squirrels, *Citellus undulatus* ssp. (Rausch, 1953), were collected in the vicinity of Anaktuvuk Pass, Alaska. They were mostly young males of the year. The squirrels were brought to the Arctic Research Laboratory of the Office of Naval Research at Point Barrow, and successfully adapted to cages. One individual died as a result of a fight with another squirrel.

[1] Deceased. Mr. Hamilton was lost in a plane crash while working at the Arctic Research Laboratory, May 1950.

Each squirrel was placed in an outdoor cage with approximately 3 feet of fine sandy gravel, suitable for burrowing, and supplied with excelsior for burrow-lining material. The squirrels were fed on available greenstuffs and vegetables—cabbage, lettuce, turnips, carrots, apples, etc.—and then gradually weaned to a diet the bulk of which was Milk-Bone dog food. The squirrels made the transition, apparently without deleterious effect, and most of the specimens went into hibernation in October and November.

On March 13 and 14, 1950, 11 of these squirrels were dug out of their burrows for the purpose of securing blood and organs for a physiological study and observations of awakening reactions were recorded. One of the 11 squirrels was dead in his burrow. Autopsy revealed the apparent cause of death as a badly infected eye; the eye socket and surrounding area were badly inflammed and pus had formed. This specimen may have died early in the fall and, when thawed for skinning, there was extensive slippage. There was little subcutaneous fat. One other of the squirrels was awake when dug out, on March 13. This animal attempted to bite and fought vigorously when pulled from its burrow. The stomach of this specimen was full of dog biscuit. The animal had large deposits of subcutaneous and peritoneal fat. It was impossible to be sure if this squirrel had come out of hibernation somewhat earlier, or if it was in an interim awakening period. Since it had not been fed since fall, it had obviously stored away some food. This observation is in keeping with the views expressed by Krog (1954). It seems possible, therefore, that these squirrels may have periods of wakefulness over the winter, when they might feed, but do not emerge. On the other hand, perhaps the animals awaken and feed inside the burrow for some time before spring emergence.

All the other animals studied, eight males and one female, were sleeping in the characteristic curled-up hibernating position. When brought into a warm room in the laboratory (temperature varying between 17 and 20°C.) they went through a fairly typical pattern of behavior. The initial activity was convulsive movements of the forepart of the body and spasmodic breathing. The rectal and oral temperatures slowly increased. The hind quarters remained motionless. Respiration in the first 5 to 15 minutes was about 8 per minute, and then increased in rate. Oral temperatures for the first 2 minutes in the laboratory ranged from 0.5 to 2.0°C. and rectal temperatures taken at the same time were lower, ranging from –1.3 to + 1.6°C. The single specimen which was awake had rectal and oral temperatures of 35.5 and 36.0°C. respectively. The details of temperature and respiration are given in Table 1.

Although there was some evidence of a rectal plug in most animals, all the specimens had feces in the lower intestinal tract. Stomachs of the nine hibernating specimens were empty of semi-solid and solid food matter. Some had a clear watery liquid in the stomach; two had the stomach full of mucus and one contained a bilious-appearing liquid. All the specimens had thick layers of subcutaneous and peritoneal fat. Brown fat (the fat of hibernation) was found

TABLE 1.—*Body temperatures and respiration rates of a squirrel while awakening from hibernation; specimen was taken from a burrow 18 inches deep, weighed 380 gm. and measured 334 mm. in body length, with a tail length of 100 mm.*

TIME, MINUTES*	TEMPERATURES, °C.		RESPIRATIONS PER MINUTE
	Oral	Rectal	
4	2.0	–0.8	6
7	2.6	0.0	7
10	3.4	0.5	8
13	4.0	1.5	8
16	4.9	2.2	7
22	6.0	3.5	6
26	7.0	4.5	7
30	8.0	5.5	8
34	8.4	6.0	10
38	8.9	6.5	10
42	9.3	7.0	11
46	10.0	8.3	10
54	11.0	9.3	18
58	12.0	10.0	18
62	12.0	10.0	18
65	12.5	10.5	—
68	13.0	12.0	22
71	14.0	11.5	18
74	14.0	12.0	20
77	14.5	12.25	18
80	15.0	12.5	18
83	15.0	13.0	20
86	15.5	13.0	20
89	15.75	13.5	24
92	16.25	14.0	26
95	18.0	14.25	28
98	Not taken†	14.5	28
101	Not taken†	Not taken†	38
104	Not taken†	15.0	38
111	19.0	16.0	42
120	21.0	15.0	40

*Following removal from hibernating burrow.
†Thermometers were removed.

in particularly heavy concentration in the scapular regions. The gall bladder in these squirrels seemed unusually large. Only one was measured: 17.5 × 13 mm. in broadest dimensions.

Post-hibernating and awakening body actions were recorded from the time the specimens were brought into the laboratory (zero time). Using as typical the data from observations of one squirrel, awakening reactions were timed as follows: 34 minutes—intermittent deep and shallow inhalations; 54 minutes—forearms, although maintained in a vertical position, moved in a circular fashion,

eyelids remained closed but were sensitive to touch, tongue was also sensitive to contact; 62 minutes—digits of the forearms moved; 78 minutes—forearms moved again in the same circular fashion; 80 minutes—convulsive bending of the forehalf of the body; 86 minutes—eyelids remained closed and tightened when touched (definitely greater sensitivity than at 54 minutes); 89 minutes—hind limbs were motionless but showed jerky and rapid response when the toes were pinched, and the pinched foot was slowly drawn up toward the body, whereas previously the hind limbs and feet were insensitive; 90 minutes—forelimbs continued their circular movement but the motions were accelerated; 92 minutes—ears and nose remained insensitive to touch but eyelids became more sensitive, there were more convulsive movements of the forehalf of the animal and inhalations increased but were irregular; 98 minutes—circular movements of the forearms were less regular and were interrupted by quivering (shivering?) actions of flank and pectoral musculature; 104 minutes—heart continued to be arrhythmic but began to show some signs of tachycardia, heart beat increased to about 78 per minute; 111 minutes—heart beat increased to 108 per minute and arrhythmia had lessened; 120 minutes—the musculature of the forelimbs and forequarters quivered constantly, heart beat continued mildly arrhythmic at about 108 per minute. It is interesting to note that the general arousal pattern seems to proceed from anterior to posterior areas of the body. The present observations are in accord with the progressive arousal changes in a variety of other hibernators (Lyman and Chatfield, 1955).

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LITERATURE CITED

Rausch, Robert. 1953. On the status of some Arctic mammals. Arctic, 6: 91–148.

Krog, John. 1954. Storing of food items in the winter's nest of the Alaskan ground squirrel, *Citellus undulatus*. Jour. Mamm., 35: 586.

Lyman, Charles P. and Paul O. Chatfield. 1955. Physiology of hibernation in mammals. Physiol. Rev., 35: 403–425.

Dept. of Biology, St. Louis Univ., St. Louis, Mo. Received September 5, 1957.

A reminder: Mammalogists meet at Washington, D.C., June 22–25. Come prepared to participate and enjoy the annual get-together. Details in the February issue, page 164.

ASPECTS OF COAT COLOR IN YOUNG VARYING LEMMINGS

By Richard M. Hansen

The pelages and molts of captive varying lemmings (*Dicrostonyx*) have been reported upon by Degerbøl and Møhl-Hansen (1943). In their account they reported (p. 9) a litter, born about the middle of March, in which each individual acquired a winter pelage shortly after birth. Quay and Quay (1956) reported that a litter of varying lemmings born on December 5, in their captive colony, possessed winter pelage at three weeks of age. Both these reports indicated that the common pelage acquired by young born in captive colonies was summer pelage. The authors were all of the opinion that the development of different pelages was not obviously correlated with daylength or temperature. Therefore, in view of the scarcity of published information on this aspect of the biology of the varying lemming, it seemed desirable to analyze the records of my own captive colony since I had observed winter type pelage in seven different litters.

The animals from which the colony stems were captured at Umiat, Alaska, in the early summer of 1955 and were transported to Fort Collins, Colorado, where they were used to establish a laboratory colony. The colony was observed for a period of 18 months. It was kept in an unheated garage with windows which admitted ordinary daylight. The observations on coat color were recorded in conjunction with other studies (Hansen, 1956; 1957*b*; 1957*c*) and experiments were not conducted under specific conditions. The need for experimental work on factors affecting pelage characteristics is stressed.

Molts and pelage in adults.—Although many of our temperate species of rodents possess a summer and winter pelage, the contrast in color between their winter and summer pelage is not as spectacular as that of the varying lemming which is dark reddish-brown in summer and white in winter. Most mammals undergo a complete molt either annually or semiannually. The adult varying lemming is usually considered one of those having two complete molts, one in the spring, and another in the fall (Degerbøl and Møhl-Hansen, 1943: 19). However, Bee and Hall (1956: 70) describe a third adult molt which results in "a second winter pelage." In most mammals the hairs are not shed and regenerated over the entire body surface simultaneously, but begin molting at one or more places and spread to the rest of the body. This process usually proceeds with a definite configurational relationship between old coat areas and new coat areas and is referred to as "molt pattern" (Hansen, 1954; Morejohn and Howard, 1956). The molt patterns of adult varying lemmings are different in the spring and fall (Fig. 1). In the spring the summer coat usually starts on the head region and progresses posteriorly and ventrally. In the fall the direction of molt is reversed and begins ventrally and progresses dorso-anteriorly. The last area to gain winter pelage is usually the head region which was the first area to gain summer pelage. The direction of molting appears to be

correlated with the color and texture of the resulting pelage in adults. That is, the molt in the fall starts ventrally, proceeds dorso-anteriorly and results in white winter pelage. The spring molt begins on the head region, is directed postero-ventrally and results in dark summer pelage. The frequency of molts and the molt patterns were irregular for some animals under laboratory conditions. The total extent of variation in pelage types was similar to those reported by Degerbøl and Møhl-Hansen (1943).

The pelages of some adults in my colony consisted of mixed hair types, blends, and spotted individuals and could not be classed as either winter or summer pelage. Typical summer pelage contains guard hairs and pile hairs that are heavily pigmented and are approximately 20 per cent larger in their maximum diameters than the nonpigmented guard and pile hairs of winter pelage. The pelages appearing as "blends" contain guard and pile hairs that are intermediate in color and diameter. Spotted individuals result whenever molting is arrested. A mixture of summer and winter hairs was acquired when molt was incomplete, i.e., occasionally the summer guard hairs were replaced by winter guard hairs, and the summer pile hairs were retained (not molted). It is possible that combinations of the three aforementioned pelages also existed in other adults. The difference in "texture" between summer and winter pelage may be due to the diameter of the guard and pile hairs since the lengths of the individual winter and summer hairs were not significantly different in adults from my colony.

Hair development in young.—The development of young varying lemmings from birth to sexual maturity has been previously reported (Quay and Quay, 1956; Hansen, 1957*c*). At birth the young are naked except for the vibrissae on the sides of the muzzle. The dorsum and head region are the first to acquire hair and the acquisition and progressive growth of hair proceeds in a caudo-ventral direction. Hair covers all of the body surface at 12 days but continues to lengthen until about 15 days when the first pelage is complete. Animals are referred to as "immatures" until they begin molting into their second pelage (Hansen, 1957*c*).

The subadult.—The immature pelage is retained until the young are from 27 to 30 days of age. At this age they start molting into their second pelage, the "subadult pelage." The molt pattern begins ventrally and the acquisition of subadult pelage progresses in the same manner as in adult lemmings acquiring winter pelage (see Fig. 1).

Coat colors of immatures and subadults.—The coat colors of immature and subadult varying lemmings have not been extensively studied. All animals born during the summer months possessed dark summer-textured pelage. However, those born during the winter months may acquire one of three different pelage types. The immature pelage of animals born during the winter in my colony consisted of either (1) whitish winter-textured pelage, (2) grayish winter-textured pelage or (3) dark summer-textured pelage (Plate I, upper left). However, the animals which I classed as having summer-type immature

pelage were lighter colored than the majority of immatures born during the summer in the environs of Umiat and Point Barrow, Alaska (Plate I, upper right). A microscopic examination of the hairs indicated that the summer-type pelage of immature laboratory animals had a texture that was different from that of wild immatures in summer pelage. The maximum widths of the guard hairs were narrower for laboratory animals which suggests that their pelages were tending to be intermediate between the winter and summer pelage of wild animals.

The subadult pelages of young born during the winter in captivity also showed three different pelage types which were different from their corresponding immature pelage types (Plate I, below). They were (1) white winter-

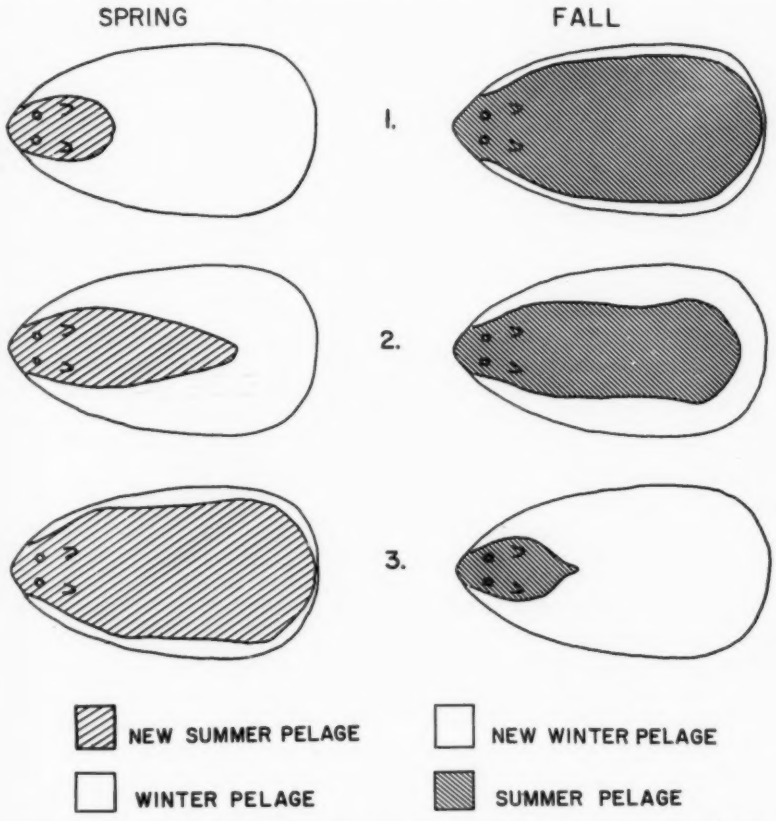

FIG. 1.—Molt patterns of adult varying lemmings in spring and fall. Spring molt (left) begins on the head region and spreads posteriorly and ventrally. Fall molt (right) begins on the venter and spreads dorsally and anteriorly.

textured pelage, (2) gray winter-textured pelage and (3) dark summer-textured pelage. Laboratory animals having dark subadult pelages were indistinguishable from wild subadults in coat color and the white winter-textured pelage was like that of adults in winter pelage. The gray subadults appeared to be intermediate between summer and winter pelage.

The subadults and immatures, although each had three pelage classes, were far less variable than adults in pelage colors and textures. The individuals could be classified as to their pelage types with certainty. It is important to

PLATE I

UPPER LEFT: Immature pelage types of captive varying lemmings; from left—whitish winter pelage, grayish winter pelage, dark summer pelage.

UPPER RIGHT: Contrast between summer coat colors of immatures born in the wild (left) and in the laboratory (right).

BELOW: Subadult pelage types of captive varying lemmings; from left—white winter pelage, gray winter pelage, dark summer pelage.

note that the molt pattern between immature and subadult pelage proceeded in the same sequence for all individuals regardless of the resulting coat color or texture in the subadult.

The timing of molt between the subadult and the first adult pelage was irregular. Some individuals retained the subadult pelage for long periods (2–3 months) while others molted rather quickly (2–3 weeks). The first adult pelage usually consisted of either a white winter pelage or a dark summer coat for animals born during the winter or late summer. However, the color and texture of the first adult pelage were correlated with the molt pattern. An irregular molt pattern resulted in pelage consisting of variable colors and textures as in old adults.

Coat colors and heredity.—The frequency of immatures and subadults with winter-textured pelage was different in the young of different females (Fig. 2). The records also indicate that the ability to acquire winter pelage by young born during the winter may be modified by heredity. The presence of three different immature pelage types in the same litter suggests even more strongly that genetic factors are involved.

DISCUSSION

Most species of birds and mammals that have a white winter coat and dark summer coat are seasonal breeders, bringing forth young only during the time they possess a dark summer coat. The varying lemming, however, is capable of breeding throughout all periods of the year, both in nature and captivity (Manning, 1954; Degerbøl and Møhl-Hansen, 1943; Sutton and Hamilton, 1932).

It has been shown by several authors that reproductive activity and coat color are closely associated and may be influenced by increasing or decreasing daylengths (Wright, 1942, 1947; Bissonnette, 1935; Bissonnette and Wilson, 1939; Lyman, 1943). In the snowshoe hare (*Lepus*) the amount of light received through the eyes has been shown to control coat color and state of reproductive activity (Lyman, 1943). Wright (1942, 1947, 1948) reported that adult weasels (*Mustela*) were always brown at the time of mating and showed a significant correlation between the spring molt in females and the time interval prior to giving birth to young. He found (1947) that males were sexually inactive while in white winter pelage and that the spring molt began at precisely the same time that the first signs of activity appeared in the testes. It was suggested that the situation in the long-tailed weasel (*Mustela frenata*) may be like that reported in the snowshoe hare, where Lyman (1943) indicated that in response to reception of increased illumination through the eyes in the spring, the gonadotrophic hormones of the snowshoe hare may be increased at the time of molt. He also indicated that with decreasing daily illumination in the fall the gonadotrophic hormones may be decreased at the time of molt. Evidence suggesting the possibility that the pineal body is a factor in photoperiodic gonadotrophic control has been summarized by Quay (1956). Appar-

ently the effects which are produced by changing the length of day are in no way dependent on the normal temperatures to which the animals are exposed.

In many ways the coat colors of varying lemmings appear to respond in much the same manner as those of the snowshoe hare and weasels. The fact that female varying lemmings that copulated while in white winter pelage always molted into dark summer pelage prior to giving birth demonstrates that the

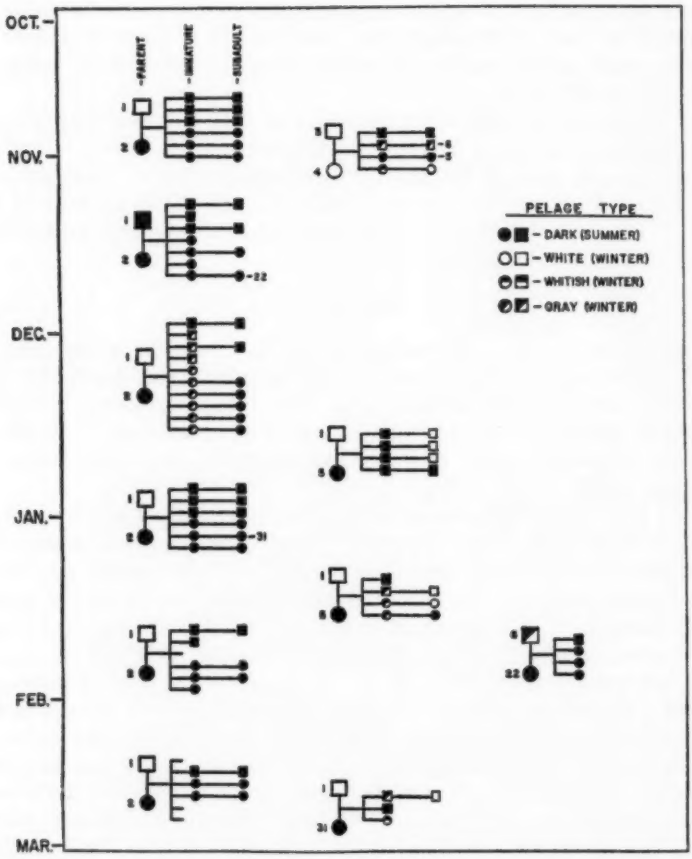

FIG. 2.—Breeding records of varying lemmings (*Dicrostonyx groenlandicus*) for winter of 1955–56. Symbols represent pelage types of parents at time of copulation, and offspring in immature and subadult stages. Numbers identify each parent. Males 1 and 3 and females 2 and 4 were litter mates captured in the wild. Crossbars between parents and offspring represent dates of birth—Oct. 23 and 27, Nov. 15, Dec. 8 and 21, Jan. 1, 14 and 24 (2 litters), Feb. 15 and 19. Laboratory temperature varied from about 30 to 60°F. Daylength was normal for latitude at Fort Collins, Colorado.

molt and pelage type are also related to the state of reproductive activity. However, Wright (1942) reported a female long-tailed weasel giving birth to a litter of young "not after the molt to brown had begun, but in January when in white winter coat." As suggested above, it appears that an increase in gonadotrophic hormones in the blood during pregnancy may stimulate females to acquire summer pelage regardless of light conditions. Male varying lemmings, on the other hand, mated successfully in all possible pelage types. I have never observed regressed testes in healthy males after they became sexually mature.

Although light may play an important role in the coat color of the adult lemming, another explanation must be given to account for the fact that some immatures gained winter-textured pelage while their litter mates did not. During embryonic development and until the immature pelage is almost complete, the young live in almost complete darkness. By the time their eyes open and they leave the nest the complete immature pelage is present. The nest chambers were essentially dark and the female always covered the young with nesting material prior to her brief departures for food. Therefore, the first daylight experienced by young lemmings was at 12 days of age when they left the nest to forage for the first time. Quay and Quay (1956) reported that, although the parents had been maintained in continuous light, they produced a litter that acquired immature winter pelage. It is assumed that all immatures of the same litter were raised under the same environmental conditions, yet some molted into winter-textured pelage and others into summer pelage. It is of interest to note that females became sexually mature at approximately the same age (27–30 days) that they began molting into their subadult pelage (Hansen, 1957*c*). Although the testes of the males are enlarged and scrotal at this age, males have not been reported as capable of successful reproduction prior to at least 46 days of age (Manning, 1954).

In view of the relationship between characteristics of reproduction and integumentary development, as they appear to be influenced by light, it is reasonable to assume that both can be initiated by a common stimulus. However, since it has been shown that normal hair replacement can occur in castrated snowshoe hares (Lyman, 1943: 442) and that in ferrets (*Mustela*) neither the integrity of the visual cortex nor the midbrain is essential to the photoperiodic response (Zuckerman, 1952), it appears that the two phenomena can take place independently of each other. In this respect the actual endocrine factors appear to be quite different and distinct. The presence of different pelage types in sexually inactive immature lemmings of the same litter also supports this view.

It is possible that some hormone crosses the placenta of the mother and influences the pelage of the immature. The fact that some young gain a different pelage than their litter mates might be explained by varying degrees of endocrine activity in the different individuals, which may be under some genetic control. However, the stimulus and actual mechanism that bring about

different pelage types in varying lemmings are far from proved and controlled laboratory experiments are lacking. The question why molt patterns and resulting pelage types are correlated in adults but not in immatures and subadults is of great interest.

Reference specimens.—Fifty-three laboratory animals representing all the pelage characteristics mentioned were prepared as museum specimens and are deposited in the Museum of Vertebrate Zoology, Berkeley, California. For loan of comparative specimens, taken in the wild, I wish to thank Seth B. Benson and Frank A. Pitelka, University of California, Berkeley. I wish also to thank Philip L. Wright, Montana State University, and Charles P. Lyman, Harvard University, for reviewing the manuscript and offering helpful suggestions.

SUMMARY

Considerable variation in coat texture and color was encountered in a laboratory colony of varying lemmings. Adult pelage appeared to be correlated with molt patterns and whenever hair was acquired by irregular molt patterns the resulting pelages consisted of variable colors and textures. Subadult pelage was acquired according to the same molt pattern as for adults gaining their winter pelage. Molt pattern was not correlated with pelage type for subadults. There were three different pelage types in subadults: white winter-textured pelage, gray winter-textured pelage and dark summer-textured pelage. Immature lemmings acquired one of three different pelage types and occasionally all three pelages were present in the same litter. Immatures acquired either whitish winter-textured pelage, grayish winter-textured pelage or dark summer-textured pelage. Evidence is presented suggesting that the ability to gain winter-textured pelage in immatures and subadults may be influenced by heredity. The relationships of the photoperiod, reproduction, molt and pelage are discussed and summarized.

LITERATURE CITED

Bee, J. W. and E. R. Hall. 1956. Mammals of northern Alaska: on the Arctic slope. Misc. Publ. 8, Univ. Kansas, Mus. of Nat. Hist., 309 pp.

Bissonnette, T. H. 1935. Relations of hair cycles in ferrets to changes in the anterior hypophysis and to light cycles. Anat. Rec., 63: 159–167.

Bissonnette, T. H. and E. Wilson. 1939. Shortening daylight periods between May 15 and September 12 and the pelt cycle of the mink. Science, 89: 418–419.

Degerbøl, M. and U. Møhl-Hansen. 1943. Remarks on the breeding conditions and moulting of the collared lemming (*Dicrostonyx*). Med. om Grønl., 131(11): 1–40.

Hansen, R. M. 1954. Molt patterns in ground squirrels. Proc. Utah Acad. Sci. Arts and Lett., 31: 57–60.

———. 1956. Extra incisors in the rodent *Dicrostonyx groenlandicus*. Jour. Mamm., 37: 549–550.

———. 1957*a*. Remarks on the bifid claws of the varying lemming. Jour. Mamm., 38: 127–128.

———. 1957*b*. Influence of daylength on activity of the varying lemming. Jour. Mamm., 38: 218–223.

———. 1957*c*. Development of young varying lemmings (*Dicrostonyx*). Arctic, 10: 105–117.

Lyman, C. P. 1943. Control of coat color in the varying hare *Lepus americanus* Erxleben. Bull. Mus. Comp. Zool., 93: 393–461.

MANNING, T. H. 1954. Remarks on the reproduction, sex ratio, and life expectancy of the varying lemming, *Dicrostonyx groenlandicus*, in nature and captivity. Arctic, 7: 36–48.

MOREJOHN, G. V. AND W. E. HOWARD. 1956. Molt in the pocket gopher, *Thomomys bottae*. Jour. Mamm., 37: 201–213.

QUAY, W. B. 1956. Volumetric and cytologic variation in the pineal body of *Peromyscus leucopus* (Rodentia) with respect to sex, captivity and day-length. Jour. Morph., 98: 471–495.

——— AND J. F. QUAY. 1956. The requirements and biology of the collared lemming *Dicrostonyx torquatus* Pallas, 1778, in captivity. Säugetierk. Mitteil., 4: 174–180.

SUTTON, G. M. AND W. J. HAMILTON, JR. 1932. The mammals of Southampton Island. Mem. Carnegie Mus., 12(2): 1–111.

WRIGHT, P. L. 1942. A correlation between the spring molt and spring changes in the sexual cycle in the weasel. Jour. Exp. Zool., 91: 103–110.

———. 1947. The sexual cycle of the male long-tailed weasel (*Mustela frenata*). Jour. Mamm., 28: 343–352.

———. 1948. Breeding habits of captive long-tailed weasels (*Mustela frenata*). Amer. Midl. Nat., 39: 338–344.

ZUCKERMAN, S. 1952. The influence of environmental changes on the pituitary. Ciba Found., Colloq. on Endocrinol., 4: 213–228.

Experiment Station, Colorado State Univ., Fort Collins. Received September 19, 1957.

ACTIVITY OF WHITE-FOOTED MICE IN RELATION TO ENVIRONMENT

BY HOWARD D. ORR

Much of the life history and ecology of small mammals can be understood in terms of daily activity. Of particular interest is change or variation of activity because this is relative to environmental factors. It can be said that changes in activity are a means of discovering and describing the influence that the environment has on small mammals.

While it is possible to work with activity change in the qualitative sense, it is perhaps better to include quantitative methods. Due to the secretive nature of most small mammals, measurement of activity under natural conditions is difficult. Direct observation, however desirable, is rarely practical because of time requirements; often it is impossible. Several indirect methods have been used. Blair (1951) was able to measure certain aspects of activity in sandy areas where tracking was possible. Ranging activity has often been measured by the trap-mark-release-recapture method, but the amount of information collected per unit of time is very low, often amounting to one record per animal each day (Blair, 1940; Burt, 1940; Stickel, 1946). Similar to this method is the nest-box technique (Nicholson, 1941; Howard, 1949). Methods dependent on infrared light (Southern *et al.*, 1946) and radioactive isotopes (Godfrey, 1954) have not yet been sufficiently refined for general use. Spencer

(1939) used an electric switch and kymograph system to record activity, but his methods did not permit control of animals entering the experiment.

Studies of activity can be taken into the laboratory. Interesting as this approach may be, it does not solve the problem since many influential factors are eliminated. Information obtained is in terms of what can happen rather than what actually does in the field situation.

The study here reported was conducted in the field with structuring of the environment to permit electrical recording of the activity of the northern white-footed mouse, *Peromyscus leucopus noveboracensis*. The object was to measure the effects, if any, of shelter, other individuals and weather on the amount, location and time of activity.

Portions of this study were presented to the Graduate School of the University of Pittsburgh as a doctoral dissertation, under the direction of Dr. C. A. Tryon, Jr. This is publication No. 15 of the Pymatuning Laboratory of Field Biology.

STUDY AREA

The study area was located in a section of forest at the Pymatuning Laboratory, Pennsylvania. The laboratory is within a wildlife reserve and the plot chosen was relatively free of human disturbance. The area had previously sustained a population of *Peromyscus*.

A 30 × 30 foot area was fenced with 24-inch copper screening (to minimize sensory distortion). The top of the fence was equipped with a vertical aluminum barrier 22 inches high. Within this larger area smaller subdivisions were formed by similar fencing (Fig. 1). All fencing was set into the ground sufficiently to prevent passage by burrowing.

Subjects were able to move from one area to another through openings located as shown in Fig. 1. These openings were fitted with treadles designed so that a mouse passing through forced an overhead leaf-type spring to close a set of contact points, completing an electric circuit. This in turn deflected a particular signal magnet, causing it to record the action on a kymograph located outside the study area. Thus the locations of all movements through treadles were time-recorded over continuous periods.

Trees included within the area were fitted with metal guards to confine activity to the ground. To increase the control of shelter as a factor, natural nest sites were removed and nest boxes were provided. Live and kill traps were used outside the area to remove the local population of mice.

PROCEDURE

Mice were trapped from several different wooded areas in the vicinity of Pymatuning Lake. Adults were chosen on the basis of coat color and general body size. No females were studied because of the possible variation in their activity due to reproductive cycles. All subjects were removed to laboratory cages and held for a minimum of 24 hours before introduction to the study area. There was some variation in the treatment of subjects because trapping

did not always produce the kind of mice desired. During confinement in the laboratory, food and water were provided and nest boxes were placed in the cages. The mice were transferred to the study area in their nest boxes, which were left there to provide a center of familiarity and lessen the tendency to escape. More than adequate food was supplied at all times.

Records were made of the activity of individuals during the first phase of the study (December, 1953 to June, 1954). Each mouse was placed with its nest box in a central part of the study area during the afternoon hours. Records of its activity were made during the following 24 hours. Other nest boxes, each with a supply of food nearby, were placed in outer parts of the study area as shown in Fig. 1, left.

During August, 1954, recordings were obtained for groups of mice. The home position of each of the six members of a group is shown in Fig. 1, right. In addition to the six mice which were permitted to range over all subdivisions, two caged mice were present. Eight groups of mice were tested, each over a three-day period. The principal object of this phase of the work was to determine if the presence of caged mice affected the others.

RESULTS

Effects of confinement.—Changing the home range of a small mammal undoubtedly alters its activity. To estimate the extent of such change in activity, direct observations were made on subjects confined to the study area. Occasionally it was possible to observe the activity of mice living near the study area. Comparison of the activity of the confined with the free mice indicated no apparent difference in terms of rate and manner of travel and

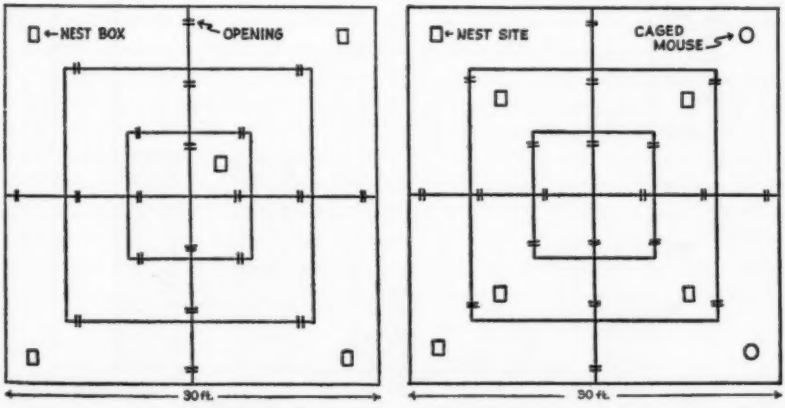

FIG. 1.—The position of fencing in the study area; openings indicate the passageways between subdivisions which were fitted with treadles. *Left:* nest boxes as arranged for testing mice individually. *Right:* arrangement of study area during recording of groups of six mice; nest sites consisted of loose piles of sticks covered by 2-foot squares of tarpaper.

reaction to environmental objects and obstacles. The more complex structure of the study area and the motivation to orient to the new situation accounted for much investigative activity along barriers, but this diminished rapidly. When mice were trapped for removal from the area, after being studied, they often escaped and returned to the area. Their ability to make directed avoidance maneuvers through the treadle openings was taken as a sign of orientation to the plan of the area. The barriers were not responsible for any appreciable restriction of the use of space.

Orientation and adjustment to the area seemed quite rapid. Animals which had been tested one night defended the area near their nest boxes. In several cases mice with but a few hours of orientation attacked intruders in subdivisions other than their own. One of the best indications of adjustment came from the reduction in escape tendency after the first few hours. It appeared that escapes were related to investigative activity rather than to escape motivation. Once the animals became oriented the investigative activity fell off, as did escapes. The presence of the familiar nest box and ample food were important.

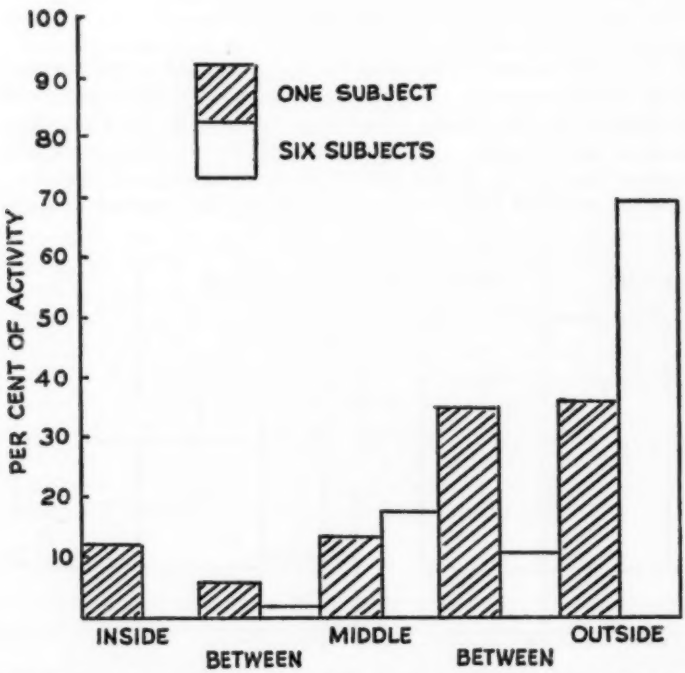

FIG. 2.—Per cent of treadle records which occurred in different areas; *inside, middle* and *outside* refer to the sets of four subdivisions; *between* refers to all barriers separating the sets of four.

Role of shelter.—The nest boxes and nest sites were important in controlling certain aspects of activity. They provided shelter during the daylight hours and were centers of activity of the subjects. During the latter part of the investigation, when six subjects were tested in each group, nest sites provided the necessary individual stability to permit the measurement of interaction between subjects. Subjects remained in the subdivisions where they were introduced, with few exceptions. Records of the moves that were made from one nest site to another throughout all tests show the influence of shelter on the stability of individuals in this sense. Of 22 single individuals recorded during 38 test-nights (a test-night denotes one animal tested for one 24-hour period), four subjects moved on five occasions. During these tests there were five nest sites per subject. Of 48 subjects tested in groups, during 144 test-nights, eight mice moved on 13 occasions. During these tests there was one nest site per subject.

The mice apparently adapted to the nesting situation provided as a home site in most cases. The small amount of moving may have been due to previously acquired tendencies (Nicholson, 1941) in situations where available nest sites outnumbered mice, or to social organization under crowded conditions.

With each nest box or nest site in a permanent position, there was small chance of collecting data on the effect of changes in shelter on amount of activity. However, on one occasion an attempt was made to determine the effect of changing the location of the home site. Six animals were recorded for three days; the activity records for the three days were 14.6, 10.3 and 7.6. The nest sites of three of the mice were moved to different subdivisions. By the next day the subjects concerned had moved to the new locations of their particular nest boxes. Activity records for the next four days were: 8.16, 17.16, 16.80 and 24.00. The increase in activity may have been due to exploration or to a holdover orientation to the old position.

Effects of other individuals.—Recordings of both single subjects and groups of subjects provided measurement of the influence of population density on daily activity. Results of recordings with one individual in the study area are given in Table 1, along with those when groups of six were present. The single individuals had a range from 3 to 79 treadle-records per test-night with a mean of 25.8. The range for groups was 10 to 68 with a mean of 32.4. Although there was a slightly higher mean associated with the greater crowding, a standard T-test did not show a significant difference between the two conditions. This was perhaps due to the amount of variation between individuals. This did not allow differences in activity due to crowding to be ruled out, but it is possible that such effects have been overemphasized (Calhoun, 1952). Work by Nicholson (1941) and Thomsen (1945) indicates that crowding could have resulted in a change of social behavior which, by cooperation, might have depressed the tendency toward increased, nonadaptive activity. On the other hand, the methods employed may have been insufficient to detect the particular type of change in activity resulting from crowding.

TABLE 1.—*Activity in various subdivisions of the study area; left—by individual subjects and groups of six subjects; right—by free mice as compared with caged mice*

ONE SUBJECT		SIX SUBJECTS						SAMPLE	1ST NIGHT	2ND NIGHT	3RD NIGHT
		Activity			Space used						
Activity	Space used	Night: 1	2	3	1	2	3				
11	7	29	20	25	8	8	8		Between free:		
6	8	29	35	45	8	8	8	1	117	79	104
13	3	40	46	23	8	9	8	2	112	60	64
43	5	27	28	35	9	8	8	3	79	116	73
7	5	36	17	15	10	9	9	4	44	46	101
27	5	68	33	28	9	10	9	5	59	7	0
3	5	32	32	10	8	8	9	6	156	71	19
5	6							7	15	48	0
14	6								Toward caged:		
66	7							1	41	21	34
11	7							2	5	20	90
79	5							3	63	106	24
57	4							4	35	10	34
49	8							5	71	17	36
8	4							6	164	106	94
54	10							7	131	91	46

Although an increase in the number of others did not seem to affect the amount of activity, the location of activity did change. Table 1 gives the number of subdivisions used by single subjects and the number used by groups of six. Under the more crowded conditions, more of the available space was utilized. Similar evidence of the effect of increased numbers on location of activity is given in Fig. 2. Single subjects were recorded in the outer four subdivisions at 36 per cent. When groups were present, 70 per cent of the records took place in these four subdivisions. Crowding apparently increased the tendency to disperse.

The effect of other individuals on the use of space has been indicated by Stickel (1946) and Calhoun and Webb (1953). Removal of mice from one area causes those from nearby sites to move into the vacant area, indicating that each mouse may be positionally stabilized by awareness of its neighbors. The possible role of direct encounters between mice in determining such positional relationships was tested by the use of mice in wire cages. These mice presumably were detected by the various senses but no direct contact, such as occurs in fighting, was possible. Caged mice were placed in subdivisions which gave free-ranging subjects a choice of ranging toward a subdivision with either a free or caged mouse (Fig. 1, right). Results of this portion of the study are given in Table 1 (right). Analysis of variance showed no significant difference between the two situations. It is possible to infer, although not conclusively, that caged animals were treated much the same as free ones and that direct contact is not necessary for maintenance of positional relationships. Further evidence in support of this inference occurred in a case of latent introduction.

Four mice, allowed the freedom of the entire study area, had mean activity levels of 28.75, 21.75 and 21.75 per individual per night during three successive periods of recording. Following the introduction of caged mice near the nest sites of the subjects, the records were 32.00, 43.00, 37.75 and 39.00.

Effects of weather.—Continuous temperature records were made during all of the recording periods. When the average temperatures for dark hours were compared with activity levels of individuals, the greatest amount of activity fell between 40° and 50°F. When the temperature was higher or lower than this, activity decreased in proportion to the deviation (see Fig. 3, left).

Relative humidity was measured at dusk with a wet-and-dry-bulb thermometer for each of the tests made during August. When activity levels for groups of mice were compared with relative humidities, the greater amounts of activity were observed at the higher range. When a point near saturation was reached, little activity was noted (see Fig. 3, left). Wind velocity, although not measured, seemed important along with temperature and humidity in controlling the evaporation rate at the level of the substrate. According to these results, and those of Chenoweth (1917), a low rate of evaporation favors activity in this species.

No relationship between barometric pressures read at dusk during the August recordings and activity levels obtained for groups of mice could be found.

Activity patterns.—The time pattern of activity recorded provided another means of relating activity to measured environmental factors. Figure 3 (right) represents the activity pattern of the individuals tested and of the groups. Although minor differences existed between the two curves, the general

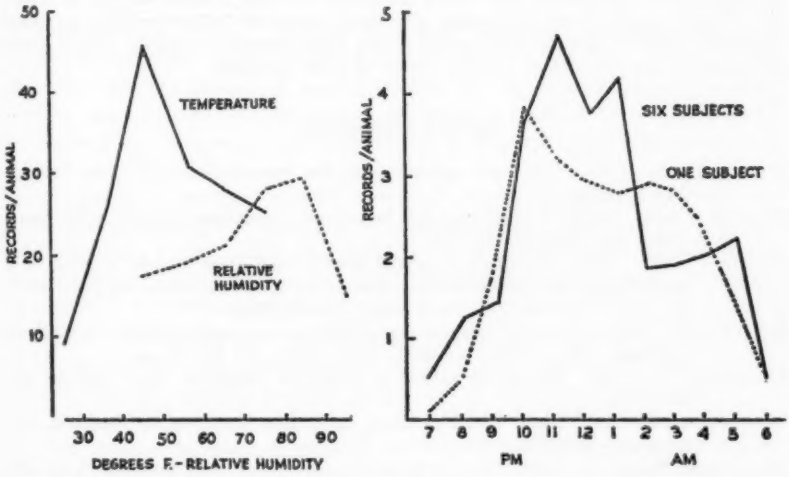

FIG. 3.—Activity patterns based on number of treadle records. *Left:* compared with temperature and humidity. *Right:* daily patterns of individual mice and of groups of six mice.

pattern was similar, indicating that population density or crowding had little effect upon the amount of activity. The activity was confined to dark hours, beginning at dusk, reaching a peak at about midnight and declining gradually until dawn. A tendency to show a slight recovery around 3:00 AM was noted.

The length of activity seemed to be the aspect most subject to change. This was due to the increased number of dark hours during the winter months. Johnson (1926) found that under laboratory conditions *Peromyscus* responded to changes in the length of light and dark periods. Both Johnson and Behney (1936) reported that hunger extended activity into daylight hours. It is quite possible that, during winter, some daylight activity occurs when light is screened out by snow or when food is difficult to locate. However, during the summer months, it is doubtful that light is a factor causing any fluctuation in the activity of these mice. Observations made on many mice during the experiment indicated that bright moonlight nights do not inhibit activity. Trapping results supported this. It is suggested that where dark, damp nights produce more captures, the chief factor may be humidity rather than darkness. Activity during rainy periods would be low except in covered portions of the environment.

SUMMARY

Activity of male white-footed mice in outdoor enclosures was recorded by electrical apparatus; mice were studied both individually and in groups, under varying environmental conditions. Activity rates of individuals showed a relationship to humidity and temperature, but not to barometric pressure; they were affected by the presence of other mice under conditions of latent introduction (reaction to intruders) but not by crowding alone. Changing the position of shelter also increased activity. Increased crowding tended to increase the activity toward the outer portions of the area. Activity rhythms were practically the same for individuals as for groups; they varied principally with the seasonal changes in length of darkness. Awareness of neighboring individuals apparently exists regardless of direct encounters, such as fighting. It is suggested that slight changes in activity offer a sound means of studying the ecology and life history of small mammals.

LITERATURE CITED

BEHNEY, W. H. 1936. Nocturnal explorations of the forest deer-mouse. Jour. Mamm., 17: 225–230.

BLAIR, W. FRANK. 1940. A study of prairie deer-mouse populations in Southern Michigan. Amer. Midl. Nat., 24: 273–305.

———. 1951. Population structure, social behavior, and environmental relations in a natural population of the beach mouse (*Peromyscus polionotus leucocephalus*). Contrib. Lab. Vert. Biol., Univ. Mich., No. 45, 26pp.

BURT, W. H. 1940. Territorial behavior and populations of small mammals in Southern Michigan. Misc. Publ. Mus. Zool., Univ. Mich., No. 48, 47 pp.

CALHOUN, J. B. 1952. The social aspects of population dynamics. Jour. Mamm., 33: 139–359.

——— AND WILLIAM WEBB. 1953. Induced emigrations among small mammals. Science, 117: 358–360.

CHENOWETH, HOMER E. 1917. The reactions of certain moist forest mammals to air conditions and its bearing on problems of mammalian distribution. Biol. Bull., 32: 182–206.

GODFREY, G. K. 1954. Tracing of field voles (*Microtus agrestis*) with a Geiger-Muller counter. Ecology, 35: 5–10.

HOWARD, WALTER E. 1949. Dispersal, amount of inbreeding and longevity in a local population of prairie deermice on the George Reserve, Southern Michigan. Contrib. Lab. Vert. Biol., Univ. Mich., No. 43, 52pp.

JOHNSON, M. S. 1926. Activity and distribution of certain wild mice in relation to biotic communities. Jour. Mamm., 7: 245–278.

NICHOLSON, ARNOLD J. 1941. The homes and social habits of the wood-mouse (*Peromyscus leucopus noveboracensis*) in Southern Michigan. Amer. Midl. Nat., 24: 196–223.

SOUTHERN, H. N., J. S. WATSON AND DENNIS CHITTY. 1946. Watching nocturnal animals by infra-red radiation. Jour. Anim. Ecol., 15: 198–202.

SPENCER, DONALD. 1939. Electrical recording of the activity of small mammals. Jour. Mamm., 20: 479–485.

STICKEL, L. F. 1946. The source of animals moving into a depopulated area. Jour. Mamm., 27: 150–159.

THOMSEN, HANS PETER. 1945. The winter habits of the northern white-footed mouse. Jour. Mamm., 26: 138–142.

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MONTHLY WEIGHTS OF SNOWSHOE HARES FROM NORTH-CENTRAL ALBERTA

BY WM. ROWAN[1] AND LLOYD B. KEITH

While seasonal weight changes have been recorded for many species of birds (Wilson, 1911; Baldwin and Kendeigh, 1937; Nice, 1937; Odum, 1949), there is a distinct paucity of similar information for most mammals. Average weights are relatively easy to secure but data on monthly or seasonal trends throughout the year are largely unavailable, particularly those occurring under natural or wild conditions.

Even for the extensively studied cottontail rabbit, *Sylvilagus floridanus*, such data as are available are frequently restricted to the hunting season or to several winter months (Allen, 1939; Elder and Sowls, 1942; Smith, 1950). When presented for the entire year (Haugen, 1942; Petrides, 1951), sample sizes are often so small that it is difficult to attach significance to apparent weight fluctuations.

Growth rates of young snowshoe hares, *Lepus americanus*, have been reported by Grange (1932), MacLulich (1937) and Severaid (1942). We have, however, been unable to discover a single paper giving snowshoe hare weights from month to month over the entire year, or even a substantial portion of it. We are therefore submitting weights of hares collected in north-central Alberta between Lat. 53° and 56° N.

[1] Deceased, June 1957.

METHODS

Approximately 75 per cent of the hares were shot with a .22 caliber rifle; the remainder were caught in snares. Of the 646 animals collected, 591 were secured between May 1950 and September 1956. The others represent scattered collections made as far back as 1933. Hares were taken at all times of the day. Seldom was weighing delayed more than 24 hours after death.

No attempt was made to distinguish between adult and juvenile hares after the end of August, hence average fall weights are an admixture of both age groups.

In the region under consideration, earliest snowshoe embryos were found on April 28 (Rowan and Keith, 1956); since the gestation period is approximately 36 days (Severaid, *op. cit.*), it is unlikely that many young are born here before mid-May at the earliest. Thus, by employing the growth data of Severaid, we were able to separate young of the year from adults during May, June and July, utilizing weight differences alone. By August this method is less satisfactory as some juvenile weights begin to approach those of adults.

The teats of female hares were checked during August for signs of recent or current suckling. Because females do not breed in the summer of their birth (Severaid, *op. cit.*), evidence of suckling was used to segregate adult from juvenile females at this time. The mean adult male weight for August must be regarded with some suspicion. Here we were forced to rely entirely on weight as a means of separating the two age classes. As is pointed out above, this practice is likely to involve some error in August.

RESULTS

Both males and females exhibit similar weight fluctuations, as shown in Fig. 1. There is an increase in weight during the fall months, culminating in December. This increase is doubtless accentuated by continued growth of juvenile animals which require 24 weeks, *post partum*, to attain a relatively stable weight (Severaid, *op. cit.*). It seems certain, however, that adults also gain through the fall since the average adult weight in August is appreciably lower than the average of combined adult and juvenile weights in November and December.

A pronounced and significant weight loss occurs in January. The slight rise in February and the gradual though steady decreases during March, April and May lack statistical significance. In June a sharp rise in weight takes place, followed by a marked reduction in August.

Although not shown in Fig. 1, fiducial limits (95 per cent level) were calculated separately for the mean monthly weights of males and females. November was found to be the only month in which a significant difference in weight occurred between the sexes. During this month the average female weight was 1554 ± 42.0 gm., while that for males was 1429 ± 61.7 gm. Mean weight from January to April inclusive was 1424 ± 34.0 gm. for females and 1390 ± 33.9 gm. for males. From May to August inclusive mean weights were 1416 ± 44.5 gm. for females and 1419 ± 35.0 gm. for males.

DISCUSSION

Changes in weight, other than those brought about by the initial growth of an animal or during pregnancy, are generally thought to represent vacillations in body fat. Many animals are known to lay on adipose reserves before hibernation and prior to the breeding season. In addition, rapid fat deposition occurs in some birds immediately preceding migration (Odum, 1949; Wolfson, 1954).

Recent studies on pheasants by Breitenbach (1958) have indicated that marked seasonal fluctuations in visceral weight, involving the gastro-intestinal organs as well as the long-recognized gonadal changes, are important causes of periodic increases and decreases in over-all body weight. Thus one must be cautious in interpreting weight gains and losses *entirely* in terms of fat, even though corresponding variations in total body fat may occur simultaneously. While recognizing this fact, the following discussion will center primarily on factors likely eliciting mobilization or deposition of fat.

There are two principal forces influencing fat build-up and loss. These are (1) Ecological—food supply, weather, cover, etc. and (2) Physiological—reproductive cycles and endogenous endocrine processes regulating fat me-

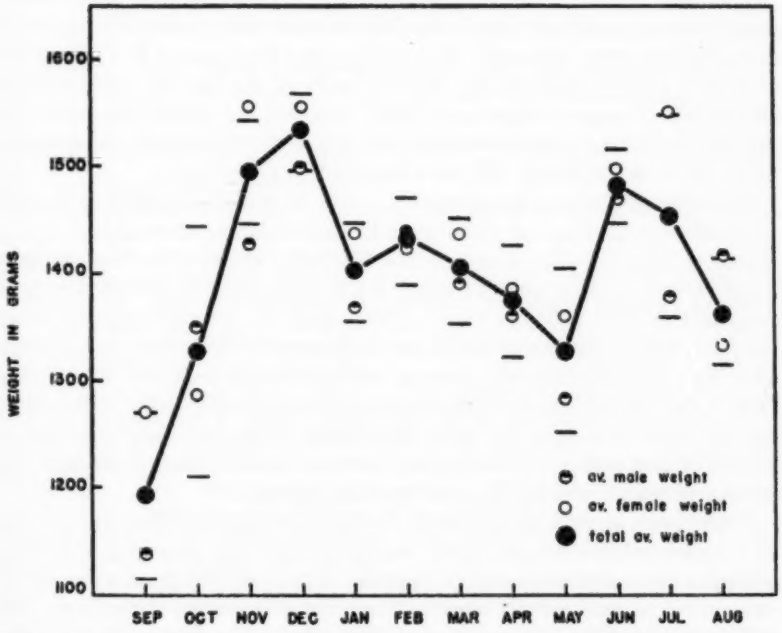

FIG. 1.—Average monthly weight of snowshoe hares in north-central Alberta showing 95 per cent confidence limits ($M \pm S\bar{x}\cdot t$) on the total average weight of both sexes. Sample size: males—318, females—328.

tabolism. There is continuous interaction between the above factors; at one time their effects may be similar and at another time opposed. Let us now briefly examine some of the possible causes of the weight changes in snowshoe hares as depicted in Fig. 1.

Ecological factors.—Food: The type of food consumed by snowshoe hares in Alberta is fairly constant from October to May. This consists primarily of the bark of aspen (*Populus tremuloides*), willow (*Salix* spp.) and alder (*Alnus* spp.). There is no real shortage of such food at any time and it is inconceivable that weight changes could be due to varying food supply. Nevertheless, it is possible that a reduction in nutritive quality occurs as winter progresses. Gastler *et al.* (1951) stated, after analyzing changes in deer browse including aspen, "All species whether palatable or nonpalatable, did not show a great reduction in . . . chemical constituents, except carotine, which might in turn be indicative of a reduction in nutritional value through the 'critical period' January to April."

The June increase in weight corresponds to the annual "green-up" of the woods in Alberta. It appears reasonable that a shift from bark and twigs to the more succulent and nutritious diet of young herbaceous plants might well account for this gain in weight.

Weather: Severaid (*op. cit.*) wrote that ". . . snow, together with subzero temperatures, caused all hares to be quite inactive and a noticeable reduction in food consumption followed." He indicated that this resulted in a slower rate of gain in young captive hares. Possibly some of the January weight loss is attributable to severe weather conditions. This does not explain, however, why the decrease is not continued through February which has equally low temperatures and snow conditions that are comparable if not worse.

Physiological factors.—Reproductive cycle: Increased energy drain through renewed sexual activity and gonad recrudescence in late winter and early spring is another potential cause of weight loss. The testes of snowshoe hares undergo a rapid enlargement in early February and by the end of the month they have descended into the scrotum (Aldous, 1937). Severaid (*op. cit.*) reported sexual behavior at the beginning of March and fertile matings before the month's end. Thus the progressive decrease in mean monthly weight from February to May (Fig. 1) may be associated with the onset of reproductive stress. Conversely, the fall gain in weight by hares may result from the absence of sexual activity or may even be an anticipatory measure evolved primarily to offset the stresses of winter and/or the next breeding season.

Endogenous endocrine processes: In his investigations, Breitenbach (*op. cit.*) discovered that hen pheasants kept in outdoor pens from August to May and fed a bare subsistence diet (a constant 45 gm. per bird per day) suddenly commenced to gain weight in early December and continued to do so until mid-February. This occurred despite increasing energy demands for maintenance due to decreasing temperatures, and suggests fundamental changes in efficiency of food conversion to fat and/or energy at different times of the

year. There is no apparent reason why pheasants should be unique in this respect and it is natural to suppose that a similar situation prevails in other birds and possibly in mammals.

To conclude, we find it difficult at this time to explain, with any degree of certainty, seasonal weight fluctuations manifested by the snowshoe hare. It is obvious that these vacillations cannot be singularly consigned to any one factor but probably reflect the complex interaction of several.

SUMMARY

A total of 646 snowshoe hares from north-central Alberta were collected and weighed, data being secured for each month of the year. Mean monthly weights are shown graphically, together with their respective fiducial limits (95 per cent level).

Male and female hares exhibit similar weight curves. Two prominent peaks in weight occur, one in December and the other in June. The only significant difference in weight between the sexes occurs in November when females weigh more than males.

It is concluded that these weight fluctuations are the result of the co-action of a number of factors rather than the effect of a single dominant agent.

LITERATURE CITED

ALDOUS, C. M. 1937. Notes on the life history of the snowshoe hare. Jour. Mamm., 18: 46–57.

ALLEN, D. A. 1939. Michigan cottontails in winter. Jour. Wildl. Mgmt., 3: 307–322.

BALDWIN, S. P. AND S. C. KENDEIGH. 1938. Variations in the weight of birds. Auk, 55: 416–467.

BREITENBACH, R. P. 1958. Functional and anatomical changes during reproduction in pheasants with special reference to incubation and breeding. Univ. of Wisc., Unpub. Ph.D. Thesis, 99 pp.

ELDER, W. H. AND L. K. SOWLS. 1942. Body weight and sex ratio of cottontail rabbits. Jour. Wildl. Mgmt., 6: 203–207.

GASTLER, G. F., A. L. MOXON AND W. T. MCKEAN. 1951. Composition of some plants eaten by deer in the Black Hills of South Dakota. Jour. Wildl. Mgt., 15: 352–357.

GRANGE, W. B. 1932. Observations on the snowshoe hare, *Lepus americanus phaeonotus* Allen. Jour. Mamm., 13: 1–19.

HAUGEN, A. O. 1942. Life history studies of the cottontail rabbit in southwestern Michigan. Amer. Midl. Nat., 28: 204–244.

MACLULICH, D. A. 1937. Fluctuations in the numbers of the varying hare (*Lepus americanus*). Univ. Toronto Studies, Biol. Ser. No. 43, 136 pp.

NICE, M. M. 1937. Studies in the life history of the song sparrow, I. Trans. Linn. Soc. N. Y., 4: 1–127.

ODUM, E. P. 1949. Weight variations in wintering white-throated sparrows in relation to temperature and migration. Wilson Bull., 61: 3–14.

PETRIDES, G. A. 1951. The determination of sex and age ratios in the cottontail rabbit. Amer. Midl. Nat., 46: 312–336.

ROWAN, WM. AND L. B. KEITH. 1956. Reproductive potential and sex ratios of snowshoe hares in northern Alberta. Can. Jour. Zool., 34: 273–281.

SEVERAID, J. H. 1942. The snowshoe hare; its life history and artificial propagation. Maine Dept. Inland Fisheries and Game, 95 pp.

SMITH, R. H. 1950. Cottontail rabbit investigations. Pittman-Robertson Project 1-R, Supp. B, N. Y. State Cons. Dept., 84 pp.

WILSON, E. A. 1911. The weight of grouse. *In*: The grouse in health and in disease, Vol. I. Smith, Elder & Co., London, xxiii + 512 pp.

WOLFSON, A. 1954. Weight and fat deposition in relation to spring migration in transient white-throated sparrows. Auk, 71: 413–434.

Dept. of Forestry and Wildlife Management, Univ. of Wisconsin, Madison. Received September 12, 1957. [Contribution of the Research Council of Alberta, Edmonton.]

NOTES ON THE HAWAIIAN MONK SEAL

BY ARTHUR SVIHLA

The Hawaiian monk seal, *Monachus schauinslandi*, may be considered one of the rarest and least known of our living mammals. This may be due to its isolated distribution, for it is restricted chiefly to the outer atoll islands of the Hawaiian chain. Except for Midway and French Frigate Shoal, these outer islands where the largest number of seals occur are uninhabited by man.

This animal was well known to the Hawaiians prior to the discovery of the islands by Europeans, for they called it "ilio-holo-i-ka-uaua," which freely translated means "the dog that runs in the tough elements."

Early reports give evidence that during the early part of the nineteenth century this seal was relatively abundant. Bryan (1915) stated that the brig "Ainoa" set out in 1824 from Hawaii on a sealing trip to these islands. In 1859 the "Gambia," which at that time discovered Midway Island, returned to Honolulu with 1,500 seal skins and 240 barrels of seal oil, some of which cargo came from Midway. Atkinson and Bryan in 1914 reported that a Mr. J. J. Williams, who visited Laysan in 1893, heard that 60 or 70 seals had been killed on this island during an earlier expedition.

The first scientific recognition of this seal was made in 1905 by Matschie. He named the species on the basis of a skull brought back from Laysan by Dr. Schauinsland, who had been on this island in 1899. Seals apparently were not very numerous on Laysan in Schauinsland's time, for he stated that "seals came singly, indeed very seldom by this island."

In 1912 the U.S. Revenue Cutter "Thetis" visited Midway and Laysan and brought back a seal skin which is now in the Bishop Museum, Honolulu, and parts of three others which are in the U.S. National Museum. Since that time other expeditions to these islands have observed seals and following is a summary of their counts of seals seen.

Numbers.—Atkinson and Bryan (1914) noted 35 seals on Pearl and Hermes; Wetmore (1925) saw numerous seals and collected ten; Blackmore (1941) reported about half a dozen on Midway; Bailey (1952) reported that in 1949 there were 100 seals on Pearl and Hermes, 20 to 30 on Laysan, eight on Midway, and that "about 70 seals had been seen" by a group who had visited Kure.

Through the courtesy of the U.S. Fish and Wildlife Service permission to scan the logs of various ships which made periodic trips to these islands was granted to this writer and

records were made of the number of seals reported. The log of the fifth cruise of the "H. M. Smith" in June, 1950, states that eight seals were seen at French Frigate Shoal, 50 at Laysan, 100 at Lisianski, 100 at Pearl and Hermes, and a few at Midway—a total of over 258. In 1951 the log of the "H. M. Smith" to the same islands, in May, reported nine from French Frigate Shoal, 174 from Laysan, 195 from Lisianski, "seals with pups on Grass Island," Pearl and Hermes; seals were not mentioned in the notes from the observations of Midway. Therefore, there were more than 378 seals recorded on this trip.

Vernon Brock reported 407 seals while on a fishery cruise aboard the "H. M. Smith" during June and July, 1951, as follows: French Frigate Shoal—12, Marco Reef—2, Laysan—119, Lisianski—70, Pearl and Hermes—180, and Midway—24.

Aerial counts were made on flights in November of 1954 by J. A. Neff and Philip DuMont with the following results: Laysan—60, Lisianski—76, Pearl and Hermes—96, Midway—25, Kure—60; a total of 317. Neff and DuMont believe that they were able to count only about two-thirds of the seals because the rest were hidden in the *Scaevola* growing on the islands.

During March, 1954, Frank Richardson counted 115 seals on Lisianski.

In January, 1955, the "H. M. Smith" reported that 26 seals were seen on Midway and 101 on Laysan.

The "J. M. Manning" visited these islands in May, 1955, and reported approximately 100 seals on Lisianski and 30 on Midway.

Through the courtesy of the U.S. Coast Guard the author was permitted to visit French Frigate Shoal on February 21, 1956. Thirty-two seals were counted from the air as follows: Tern—0 (four days earlier), small island in front of Trig—4, Trig—4, Skate—10, Whale—7, Round—2, Mullet—3, East—1, on reef—1. Not all of the small islets in this group were seen from the air.

Indications are that perhaps as a result of the strict laws for their protection as well as adequate patrolling against poachers this seal is on the increase. Their numbers have increased not only on the outer islands but also on the "Big Islands," as attested by reports of sight records in the Honolulu papers.

General habits and movement.—In the water these seals are very agile and swim with great ease and speed. Locomotion in the water is accomplished primarily by an undulation of the posterior part of the body and the laterally adpressed hind flippers. While swimming horizontally at the surface of the water they sometimes raise the entire foreparts of the body above the water in order to make observations. They can also remain in an upright position in the water with their heads and forequarters above water.

On land, however, these animals are very slow-moving and locomotion is both labored and strenuous. The foreflippers are relatively short in comparison to the size of the animal, and although these seals can use their hands very dexterously for scratching the body and rubbing the eyes, nevertheless their use in locomotion on land is limited in comparison to that of the sea lion or fur seal.

Movement on land is accomplished by a dorso-ventral undulation of the entire body during which the flippers serve primarily as balancers. These may be held close to the body or at right angles, and only occasionally do they come in contact with the ground. The body is not raised very high off the ground. The body undulation apparently requires considerable exertion, for the animal normally advances about its length and then stops to rest. This is true regardless of whether the seal is moving up or down a sloping beach. In fact, the seals sometimes assist their movement down the beach by rolling over and over sideways, holding their foreflippers close to the body.

It may take a seal several minutes to move 30 feet. While resting between lunges the seal usually raises its head and looks about. This raising of the head in observation is a characteristic habit and occurs at intervals even when the seal has reached its chosen resting place. Occasionally the seals sleep with their hind flippers or heads completely submerged

in the water, but usually the waves breaking on these parts of their bodies disturb them and they move higher up on the beach. Here they may dig themselves in by wiggling the body and head to form a crescent-shape depression a foot or more deep. All sorts of positions are assumed while lying at rest, on their bellies, on their backs or on their sides. Whenever they awaken from sleep they raise their heads and look about before going to sleep again. If anything arouses their curiosity their heads are kept aloft until they are satisfied that there is no danger. Or if they see something strange, like a human being walking about, they move down the slope of the beach into the water.

A mated (?) pair of these seals on French Frigate Shoal were observed to alternate in this observatory action. Usually it was the female who raised her head to look about. When the male raised his head he also usually bellowed. Perhaps this bellowing on the part of the male occurs only during the breeding season. Captivity may modify the observatory action, for the Hawaiian seals in the Waikiki Aquarium, while resting on the island in the center of their pool, paid little attention to the numerous visitors. Upon awakening they merely opened their eyes for a few moments and then went back to sleep.

In the wild state these seals can and do distinguish between horizontal and vertical objects, for the latter usually frightened them. While observing a pair on French Frigate Shoal, I was able to get within a few feet of an animal by crawling and remaining in a horizontal position. When I stood upright the seals immediately became nervous and suspicious. Even when awakening, they looked around in my direction very searchingly and, if I were standing erect, often moved down the beach to the water. However, whenever I lay in a horizontal position again they became qui t, even if they had already started to move down to the water.

Breeding habits.—Practically nothing is known concerning the breeding habits of this seal. That the breeding season is prolonged is evident from reports that pups have been born in every month from December to June.

Growth, molt and development.—Some estimate of growth can be made from the following observations on the two seals (Waldo and Lucille) in the Waikiki Aquarium. The female was captured at French Frigate Shoal and brought to the Aquarium in January, 1955. She still retained her black pup fur.

The male was also captured at French Frigate Shoal but in June, 1955. He too had black pup fur and was judged to be about 46 inches long. By March 6, 1956, Waldo had grown to a length of 7 feet. He had therefore increased in length by 38 inches in 202 days, or slightly less than ⅛-inch per day. It is recognized that these data are only approximate and that much more accurate data obtained from the field is essential.

Molt.—Molting was first evident in the female on January 17, 1956, when areas of new fur were seen on the posterior part of the belly in front of the navel. By February 8 the entire underside of the body and most of the head had new fur. Two small spots of new fur appeared on the back in the midline, one between the forelimbs and the other about the middle of the back. By February 24 she had an entirely new coat of dull gray fur. Thus the female molted twice during her first year, changing her black pup fur to a brown juvenile coat and then to the adult dull gray.

Respiration.—After these seals have been out of water and on land for a short period of time an accumulation of bubbly mucous, looking like buttermilk, appears in the nostrils. This mucous accumulation is removed when the seals clear their nostrils periodically by vigorous snorting, which can be easily heard 100 feet away. While the animal is stretched out on its side the lower nostril is usually kept closed and the upper one is used for breathing.

As in other pinnipeds the respiration of the Hawaiian seal is characterized by its irregular rhythm. This is associated with their prolonged submersion during dives (Irving, 1939).

Observations were made on the rate and rhythm of respiration in both captive and wild animals. All data usually were obtained while the animal was asleep. Five animals furnished the data; two of these were captives (Waldo and Lucille) and the other three were wild.

The rhythm of respiration was determined by observing and counting the opening and closing of the valvular nostrils. The rate was determined by means of a stop watch calibrated in tenths of a second.

The irregular rhythm occurs both while the animal is at rest on land as well as when active in the water, and is characterized by a series of short breaths (eupnea) of various duration and sequence followed by a period of prolonged arrested respiration (apnea).

Data obtained from all five animals showed that during eupnea the respiratory cycles varied from 10 to 59, and in duration from 1.2 to as long as 59 seconds (it is possible that the latter may actually be a period of apnea). The average duration of 262 counts of eupnea in both wild and captive animals was 12.5 seconds.

The periods of apnea varied in duration from slightly over a minute (1 minute 8 seconds) to as long as 5 minutes 36 seconds. The average duration of apnea was 2 minutes 38 seconds.

A wild seal seen swimming about the reefs at French Frigate Shoal had a period of submersion of 2 minutes and 22 seconds. This is comparable to the period of apnea recorded while the animals are on land.

In the same pool at the Waikiki Aquarium with the two Hawaiian seals was a 4-foot harbor or hair seal (*Phoca vitulina richardi*) from Tacoma, Washington. This animal had a favorite sleeping position in the overflow outlet of the pool. Here this seal would lie asleep with its head submerged under water. Its respiratory rhythm was found to be ten cycles of eupnea followed by a period of apnea. The duration of apnea varied from 1 minute 7 seconds to 1 minute 36 seconds, with an average of six apneas being 1 minute and 19 seconds. Bartholomew (1954) records the longest duration of apnea in the northern elephant seal (*Mirounga angustirostris*) as being 9 minutes 15 seconds, with an average of 5 minutes 16 seconds.

The Hawaiian seal is intermediate in size between the large elephant seal and the small hair seal and has periods of apnea also intermediate in duration.

LITERATURE CITED

Atkinson, A. L. C. and W. A. Bryan. 1914. A rare seal. Bull. N.Y. Zool. Soc., 16: 1050–1051.

Bailey, A. M. 1952. The Hawaiian monk seal. Museum Pictorial, Denver Mus. Nat. Hist., No. 7: 1–30.

Bartholomew, G. A., Jr. 1954. Body temperature and respiratory and heart rates in the northern elephant seal. Jour. Mamm., 35: 211–218.

Blackmore, T. M. 1941. Rarest seal. Natural History, 47: 138–139.

Bryan, W. A. 1915. Natural history of Hawaii. Honolulu. 596 pp.

Irving, L. 1939. Respiration in diving mammals. Physiol. Rev., 19: 112–134.

Matschie, P. 1905. Eine Robbe von Laysan., S. B. Ges. Natur. Fr., Berlin. Pp. 254–262.

Wetmore, A. 1925. Bird life among lava rock and coral sand. Nat. Geogr. Mag., 48: 77–108.

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AN ANTLERED DOE WITH POSSIBLE MASCULINIZING TUMOR

By J. Kenneth Doutt and John C. Donaldson

On November 28, 1955, Richard A. Bauman was hunting deer in Westmoreland County, about 5 miles east of Ligonier, Pennsylvania. About 3:00 PM he shot what he thought was a male deer, for it was carrying a good set of antlers (Plate IA). When he came to dress it out, however, he discovered, much to his astonishment, that it was a female. He removed the entrails but was careful not to destroy the external genitalia. When I learned about the incident the following day I made arrangements to examine the specimen. It was good-sized deer (*Odocoileus virginianus*), measuring: total length, 71¾; tail, 8; hindfoot, 18¾; ear, 6 inches. With the entrails removed, it weighed 140 pounds. The external genitalia were typical of a female deer but no examination of the internal reproductive tract was possible. I examined the nipples for milk, but found none. They were small, but nevertheless larger than would be expected in a male. The neck was not noticeably swollen, differing in this respect from the typical male at this time of year.

When I explained to Richard Bauman how important it would be to have the internal genital organs he returned to the woods that same night and retrieved them. They were frozen and in good condition. Unfortunately, however, some of the most essential parts were missing, as will be explained further in Donaldson's discussion.

From an examination of the skull and teeth I would judge the animal to be about 6½ years old. All of the adult teeth were present and the molariform series was well worn.

The antlers measure, according to Boone and Crockett Club regulations:

		Left	*Right*
Number of points on each antler		4	2
Tip to tip spread, in.	3		
Greatest spread, in.	8⅝		
Inside spread main beams, in.	7		
Length of main beam, in.		11⅛	10⅝
Length of first point, in.		1	4⅞
Length of second point, in.		1⅛	
Length of third point, in.		2⅛	

Of special interest, too, is the fact that the antlers are well developed; the velvet has all been rubbed off, and they are well polished. They grow out from a typical pedicel and around the base of each is a good corona, the one around the right antler being somewhat more complete and more typical than that around the left. The antlers are not symmetrical. The one on the right has a long fork or prong, while the left antler is slightly larger and has three short tines near the base. Three conspicuous bony ridges run upwards along the main beam, the central one of which is the most irregular and most prominent.

No one knows how many female deer in Pennsylvania may be carrying antlers, but Roger Latham, who was at that time Chief, Division of Research, for the Pennsylvania Game Commission, tells me that reports are received

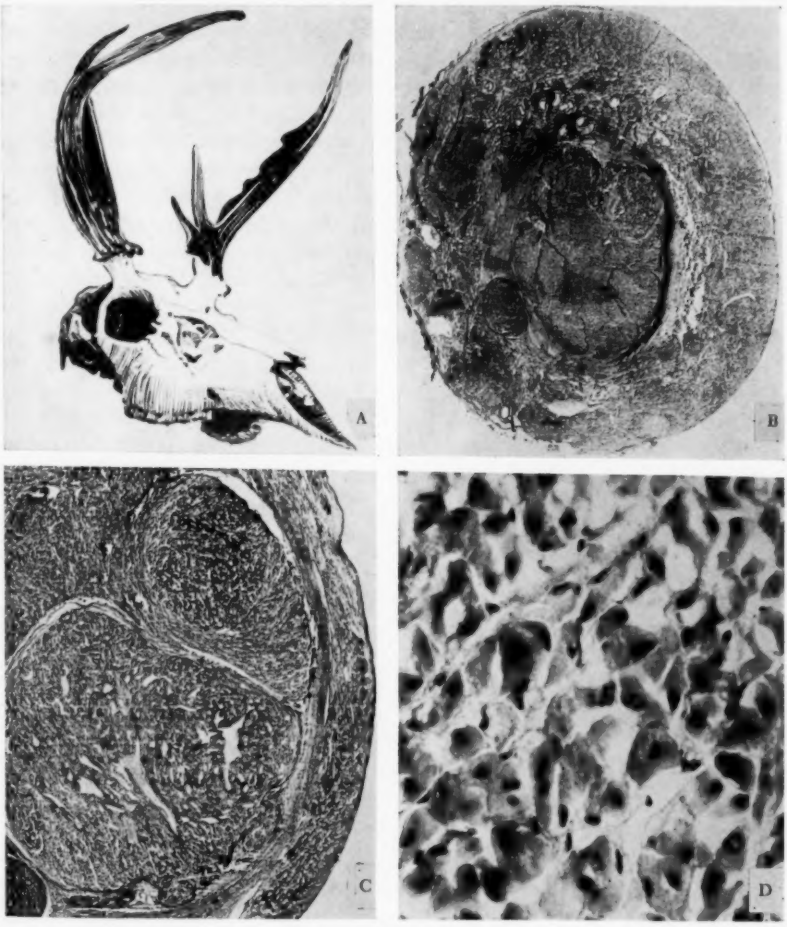

PLATE I

A—Drawing of the specimen by Cliff Morrow of the Carnegie Museum Staff; × ¼. B—Section of entire tumor, stained with hemotoxylin and eosin; note encapsulated masses and group of large blood vessels in lower quarter of figure; × 6. C—Section of tumor in a plane at right angles to that of B; the nodular character of the tumor and the compression of the outer layers of cells beneath the capsule can be seen; same stain; × 18. D—A group of uncompressed cells in the tumor; same stain; these cells resemble those found in the cortex of the adrenal gland; × 300.

of two to four such deer each year. In the past ten years an average of approximately 33,000 antlered deer have been killed each year; this would be one antlered doe to each 8,000 to 16,000 bucks. There is no way to tell how many more may be killed but not reported.

In a further effort to get more information about the numbers of antlered females, I learned from L. D. Fay, Game Pathologist for the Michigan Department of Conservation, that there are reports of two or three antlered does killed each year in Michigan. Since the annual buck kill is about 70,000 this makes a ratio of one antlered doe to each 20,000 or 30,000 bucks. There are certainly a few others killed which are not reported, so the actual average would undoubtedly be somewhat less than this. The difference in percentage between Michigan and Pennsylvania is more apparent than real, I am sure, and if actual averages were available I believe the true figure would be considerably under either of these.

Antlered does seem to fall into two classes: those in which the antlers remain permanently in the velvet, and those in which the velvet is rubbed off and the antlers are polished and well developed, similar to those of the male. Examples of this latter group are exceedingly rare in the white-tailed deer. The late George B. Wislocki (1956), in his studies, examined only one such specimen.

Does belonging to the first group are usually fertile and frequently have young; their antlers are usually small, very asymmetrical and are apparently never shed. Does belonging to the second group are evidently much rarer; we have no proof of their ever bearing young, although their external genital organs may appear like those of a normal female. The antlers grow larger, are somewhat more symmetrical and may be shed as in the male. So far as our knowledge goes, these deer are usually hermaphrodites or pseudohermaphrodites. Our present specimen, Carnegie Museum No. 39,887, is an interesting example of this second group. For a further discussion on this subject, see Wislocki (1954, 1956), Taft, Hall and Aub (1956) and the bibliographies therein.

Antlered does are so uncommon and our need for further knowledge about the causes of antlered growth in females is so great that every antlered doe should be studied carefully. We are deeply indebted to Richard Bauman and his father, J. Fred. Bauman, of Wilkinsburg, Pennsylvania, for making this specimen available to us for study and for presenting the skull and skin to Carnegie Museum.

Histological report.—The eviscerated material brought in for gross and histological examination consisted largely of digestive tract and fat. The mass was frozen throughout and largely drained of blood. In the retroperitoneal fat both kidneys and both adrenals were easily seen. When the ureters were traced caudally it became evident that most of the pelvic organs had been left in the carcass so that no gross indications of ovaries, tubes or uterus were observed.

This has left the question of abnormalities in the internal reproductive tract in doubt.

Close to the cut lower end of the right ureter there was an oval-shaped orange-colored body roughly 12 by 18 mm. in size which, like the kidney and adrenals, was easily shelled out of the surrounding connective tissue. Its surface was smooth and glistening. There was no evident hylus, and blood vessels and other structures were not noted in the gross, in the surrounding tissue. When cut this body, which was of a soft consistency like glandular tissue, seemed to have a definite capsule from which the central material shrank away. The orange color extended throughout, but the central mass showed lighter and darker areas without obvious structural arrangement. The body was tentatively considered as of parasitic origin or an atypical corpus luteum. It was cut into three parts and fixed in Bodian II fixative, then embedded in paraffin and sectioned at 10 μ, serially. Every thirtieth section was stained with hematoxylin and eosin. The right adrenal was treated in the same way. Examination of the adrenal sections showed that the tissue, in spite of four days in the woods, had been sufficiently well preserved to repay study. When examined microscopically the orange-colored body under investigation showed a distinct connective tissue capsule. Beneath this was a layer made up of large cells associated with numerous blood spaces and a connective tissue framework without definite trabeculae extending into the body from the capsule. Plate Iʙ, taken at a low power and Iᴄ, taken at a higher power and in a plane at right angles to Iʙ, show the characteristics of the body. Within the capsule can be seen masses of similar cells, each mass surrounded by its own capsule, compressing the original cells between their secondary capsules and the capsule of the tumor itself. It is a picture similar to that not infrequently seen in localized overgrowth in the cortex of the adrenal gland.

Plate Iᴅ shows the typical arrangement of the cells. The differences in density noticeable at low powers seem to be due to the degree to which the cells have been pressed together rather than to any difference in the cells themselves. These cells are large polyhedral cells with eccentrically placed nuclei. The nuclei have sharp outlines and are filled with reticular nuclear material without a clear-cut nucleolus. They are irregularly arranged and, where not markedly compressed, are separate from one another. The sections brought out several other points. Within the body, as can be seen in Plate Iʙ, there are areas of degeneration and areas containing a group of heavy-walled arteries. In the surrounding connective tissues near the orange body there was a similar, but much larger, group of such vessels. Associated with these was a length of oviduct close to the ovarian end. The body was evidently in or closely associated with the broad ligament. No traces of the ovary itself could be seen and the body itself showed no suggestion of ovarian tissue.

At this point it was evident that we were dealing with an abnormal structure so the material was submitted to Joseph D. Feldman, of the Department of Pathology, Medical School, University of Pittsburgh, for an expert opinion.

He kindly examined the sections and reported that they were from a tumor which was not malignant. The cells were of the type found in the cortex of the adrenal gland. These cells could come from cortical tissue frequently found outside the adrenal gland itself (adrenal rests or Marchand bodies), or from cells derived from the interstitial tissue of the testis or of the ovary, and likewise found outside these organs. Several other pathologists also looked at the sections but not with the same care. They agreed with this diagnosis. We are very grateful to Dr. Feldman for his essential help in interpreting this tumor.

It was disappointing not to be able to limit the diagnosis to one type of tumor. However, the cells forming these three tumors have several things in common in spite of their apparently divergent origin: (1) Embryologically, each tumor is composed of cells derived from the mesoderm of the region from which both the adrenals and the gonads are differentiated; (2) the cells of all three types are indistinguishable from those of the adrenal cortex with ordinary stains; (3) there are case reports in which each of these types has been associated with production of male sex hormone and had a virilizing (or masculinizing) effect in human patients. James and Shupe (1950) quote the pathologist H. J. Karsner as follows: "I have seen the same picture [as that found in a virilizing testicular tumor under discussion] in virilizing tumors of the ovary. I think both the ovarian and testicular tumors are of adrenal origin." This would seem to cover the type of tumors with which we are dealing.

The literature on this subject is extensive but diffuse. Marchand's paper (1883) established the existence of adrenal rests in man. These observations were extended by Pick (1901) and by later investigators. Glynn (1912) collected several cases where such tumors were associated with secondary sex changes in women. These included extensive growth of hair on the face, deepening of the voice and interference with menstruation. In a recent textbook of pathology of the endocrine glands (Paschkis, Rakoff and Cantrow, 1954) the situation is briefly summarized. The authors point out the similarity of the tumors from the three sources mentioned, their not infrequent occurrence and the few but definite cases (20 in all) in which they have been associated with virilizing effects.

All these reports have dealt with human patients. However, adrenal cortical rests have been found in other animals, as reported by Vincent (1912) and Bourne (1949), to mention only two, but only in the smaller varieties. So far as we could find, there were no reports in the literature of such rests in deer. In view of this fact a full description with illustrations seemed desirable.

There is another aspect of the subject, the studies on does with antlers. One of the most extensive of these studies is by Rörig (1899, 1907). He collected does with antlers from the great estates and hunting forests of Germany. He reported that the growth of antlers was associated with cryptorchidism, hermaphroditism, pseudohermaphroditism and even with simple atrophy of the ovary. His article contains 69 illustrations of various types of antlers. He seems to have drawn

his conclusions on the condition of the organs from macroscopic examination only, for he presents no tangible histological evidence. His conclusions are summed up and analyzed by Wislocki (1954).

The first experimental approach was by Wislocki and his associates (Wislocki, Aub and Waldo, 1947). They describe a series of experiments during which they injected testosterone propionate into castrated female deer. Growth of antlers resulted. In this paper these authors discuss thoroughly the endocrine factors which govern antler formation. This work has been followed by field observations (Wislocki, 1954). The report describes the histological examination of adrenals and reproductive organs of three antlered does. Abnormalities which would account for their antlered condition were not found. Other studies on the general question of antler formation have been continued by Taft, Hall and Aub (1956), Wislocki (1956) and Buechner (1957).

Conclusions.—We have the fact that tumors of the cortical adrenal type may produce a virilizing effect in women. It is established that, under certain experimental conditions, male sex hormone can cause the growth of antlers in does. In our case the presence of antlers in a doe was associated with the existence of a tumor made up of cells known to produce masculinizing hormone (under rare conditions) in women. This suggests that such tumors may be one of the causative factors in the production of antlers in does but many more observations of animals killed in the field and checked in the laboratory will be necessary before this can be more than a suggestion.

SUMMARY

The case of a white-tailed doe with antlers is described and the frequency and characteristics of antlered does are examined and discussed. An accompanying tumor made up of adrenal cortical type cells is described. Since such tumors are known occasionally to have a masculinizing effect in women, there is the possibility that this tumor might be a factor in the growth of antlers in this female. The great need for further field observations is pointed out.

LITERATURE CITED

Bourne, G. H. 1949. The mammalian adrenal gland. Oxford University Press, London.

Buechner, H. K. 1957. Three additional records of antlered female deer. Jour. Mamm., 38: 277–278.

Glynn, E. E. 1912. The adrenal cortex, its rests and tumors; its relation to other ductless glands and especially to sex. Quart. Jour. Med., 5: 157–193.

James, D. C. and R. D. Shupe. 1950. Interstitial cell tumor of the testicle with report of a case. Jour. Urology, 63: 718–723.

Marchand, F. 1883. Über akzessorische Nabennieren im Ligamentum latum. Arch. f. Path. Anat. (Virchow), 92: 11–19.

Paschkis, K. E., A. E. Rakoff and A. Cantrow. 1954. Clinical endocrinology. Hoeber-Harper Co., New York. Pp. 475–476.

Pick, L. 1901. Die Marchandischer Nebennieren und ihre Neoplasmen nebst Untersuchungen über glykogenreiche Eirstockgeschwülste. Arch. Gynaekologie, 64: 670–835.

Röric, A. 1899. Welche Beziehungen bestehen zwischen der Reproductionsorganen der Cerviden und der Geweibildung derselben. Arch. f. Entwicklungsmech. der Organ. (Roux), 8: 382–447.

———. 1907. Gestaltende Korrelationen zwischen abnormer Körperkonstitution der Cerviden und Geweihbildung derselben. Arch. f. Entwicklungsmech. der Organ. (Roux), 23: 1–150.

TAFT, E. B., T. C. HALL AND J. C. AUB. 1956. The growth of the deer antler. N.Y. State Conserv., 10: 4–5.

VINCENT, SWALE. 1912. Internal secretion and the ductless glands. Edward Arnold, London.

WISLOCKI, G. B. 1954. Antlers in female deer, with a report of three cases in *Odocoileus*. Jour. Mamm., 35: 486–495.

———. 1956. Further notes on antlers in female deer of the genus *Odocoileus*. Jour. Mamm., 37: 231–235.

———, J. C. AUB AND C. M. WALDO. 1947. The effects of gonadectomy and the administration of testosterone propionate on the growth of antlers in male and female deer. Endocrinology, 40: 202–224.

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THE ZOOGEOGRAPHICAL LIMITS OF THE WEST INDIES

BY KARL F. KOOPMAN

The West Indies are of great interest to zoogeographers, who have usually considered them as constituting a special Antillean subregion of the Neotropical region (Hershkovitz, 1958). As with any zoogeographical region or subregion, the question of limits soon arises. This is less difficult in the case of an insular subregion than of a continental one but, even in the case of the Antilles, there are certain islands which form a sort of border zone. The problem is whether certain islands should clearly be included and others clearly excluded from the West Indies.

There is general agreement that the four main Greater Antillean islands and the chain of chiefly volcanic islands of the Lesser Antilles, extending south to Grenada, are to be considered the core of the West Indies. Other islands are either interspersed among these, e.g. Mona (between Hispaniola and Puerto Rico), or at least are clearly Antillean faunistically, e.g. the Bahamas (see Koopman, Hecht and Janecek, 1957; Rabb and Hayden, 1957), and so also are generally agreed to be West Indian. On the other hand, all islands on the continental shelf, such as Trinidad, Aruba, the Corn islands, etc., are generally agreed to be outside the Antillean subregion. More disputed are a series of islands in the western and southern Caribbean which are off the continental shelf, but not far from it, and which at the same time are rather distant from the West Indian islands previously mentioned.

There are a number of these islands, but the only ones on which mammal collections appear to have been made are the following: Cozumel off Quintana Roo; Half-moon Cay off British Honduras; Roatan, Bonacca, and Swan off Honduras; Providencia and San Andreas off Nicaragua; Curacao and Bonaire off Venezuela. The known mammalian fauna of each of these islands will be

discussed in turn. The various species will be scored according to whether they or their closest relatives occur on the mainland, in the West Indies, or on both (indeterminant). The nomenclature has in some cases been changed to conform with Miller and Kellogg (1955) or other recent treatments. Subspecies have been ignored.

WESTERN CARIBBEAN ISLANDS

Cozumel.—The important references are Andersen (1908), Goldman (1914), Merriam (1901) and Thomas (1888). Gaumer (1917) was also consulted, but was considered to be of doubtful reliability. Specimens from Cozumel collected by Gaumer in the Museum of Natural History, University of Kansas, have been checked, however, and have provided some additional records. The known mammals are as follows: *Didelphis marsupialis*–mainland; *Chilonycteris parnellii*–indeterminate (see Koopman and Martin, 1959, for nomenclatorial discussion); *Micronycteris megalotis*–mainland; *Mimon cozumelae*–mainland; *Glossophaga soricina*–indeterminate; *Artibeus jamaicensis*–indeterminate; *Centurio senex*–mainland; *Lasiurus borealis*–indeterminate; *Tadarida yucatanica*–mainland; *Molossus rufus*–mainland (see de la Torre, 1955, for nomenclature); *Ateles geoffroyi*–mainland; *Tamandua tetradactyla*–mainland; *Heterogeomys hispidus*–mainland; *Oryzomys cozumelae*–indeterminate; *Peromyscus leucopus*–mainland; *Procyon pygmaeus*–mainland; *Nasua nelsoni*–mainland; *Galictis canaster*–mainland; and *Tayassu* (*Pecari*) *tajacu*–mainland.

Gaumer also records *Peromyscus yucatanica* and *Dicotyles labiatus*, but these are suspected to be actually *P. leucopus* and *T. tajacu*, respectively. The University of Kansas has a *Corynorhinus* labeled as collected on Cozumel, but this is suspect on geographical grounds. It is clear that Cozumel has numerous mainland forms but no distinctively West Indian species and, hence, would not be included in the Antillean subregion on mammalogical grounds.

Half-moon Cay.—The only mammal record I have discovered is of *Artibeus jamaicensis* (Andersen, 1908), which is interminate. The position of Half-moon Cay, between Cozumel and Roatan, makes it reasonable to exclude it from the West Indies along with them.

Roatan.—The important references are Andersen (1908), Goldman (1911) and Thomas (1888, 1901). The Chicago Natural History Museum has a good collection made by D. Dwight Davis that has provided additional records. The known mammals are as follows: *Didelphis marsupialis*–mainland; *Marmosa mitis*–mainland; *Saccopteryx bilineata*–mainland; *Glossophaga soricina*–indeterminate; *Artibeus jamaicensis*–indeterminate; *Molossus major*–indeterminate (see Hershkovitz, 1949, 1951, for nomenclature); *Oryzomys coues*i–indeterminate; *Sigmodon hispidus*–mainland; and *Dasyprocta ruatanica*–mainland.

The presence of several mainland species or species groups and the absence of any distinctively West Indian elements indicates that Roatan should not be considered part of the Antillean subregion on the basis of the mammalian fauna.

Bonacca.—The only mammal record I have been able to locate is for *Sigmodon hispidus* (Thomas, 1888). This mainland element places Bonacca outside the West Indies on a mammalian basis.

Swan.—The only mammal is *Capromys* (*Geocapromys*) *thoracatus* (see Allen, 1911) of clear West Indian affinities. The island is therefore best considered part of the Antillean subregion as far as mammals are concerned.

Providencia (*Old Providence*).—Allen (1911) recorded two species: *Artibeus jamaicensis* (indeterminate) and *Natalus* (*Chilonatalus*) *brevimanus* (Antillean). I therefore include Providencia in the West Indies, considering only the mammalian records.

San Andreas (*St. Andrews*).—The only mammal record is of *Artibeus jamaicensis* (see Allen, 1911). While this is indeterminate, I tentatively include San Andreas in the Antillean subregion on the basis of its close proximity to Providencia.

SOUTHERN CARIBBEAN ISLANDS

Curacao.—The most important reference is Hummelinck (1940). The American Museum of Natural History also has specimens collected by McGuire which have helped to determine the status of some species. The species known from Curacao are as follows: *Mormoops megalophylla*–mainland; *Glossophaga longirostris*–indeterminate (Hummelinck, I think erroneously, allocated Curacao *Glossophaga* to *G. soricina*; Miller [1900] described it as a new species, *G. elongata*; I agree with Miller concerning identification, but feel that additional material makes it more reasonable to consider *G. elongata* a subspecies of *G. longirostris*; this point is considered somewhat more fully in another paper [Koopman, 1958]); *Leptonycteris nivalis*–mainland (Hummelinck lists this as *L. curasoae* but Hoffmeister [1957] considers it a subspecies of the Middle American *L. nivalis*); *Natalus tumidirostris*–mainland (Hummelinck uses the generic name *Phodotes* but Dalquest (1950) has shown that this is a synonym of *Natalus*; Dalquest, however, omitted reference to the Venezuelan mainland race, *N. t. continentis*); *Myotis nigricans*–indeterminate; *Molossus major*–indetermininate (see Hershkovitz, 1949, for nomenclature); *Sylvilagus floridanus*–mainland (see Hershkovitz, 1950, for nomenclature).

Hummelinck also records "*Oryzomys* sp." which, without any definite species identification, must be considered indeterminate. Since there are several forms with mainland affinity and none with definite West Indian affinity, Curacao is considered to be outside the Antillean subregion on the basis of its mammalian fauna.

Bonaire.—Hummelinck (1940) recorded only *Molossus major*. The American Museum of Natural History, however, has material of *Glossophaga longirostris* and *Myotis nigricans* collected by McGuire. The second is represented by a single specimen with a forearm length of 29 mm., which agrees well with the diagnosis of the Curacao race, *M. n. nesopolus*, given by Miller and Allen (1928). While all three species are zoogeographically indeterminate, the close

proximity of Bonaire to Curacao and the close resemblance of its few bats to those of the latter island make allocation outside the Antillean subregion most reasonable.

SUMMARY

To summarize the above conclusions on mammalian evidence, Swan, Providencia and San Andreas are considered part of the Antillean subregion. Cozumel, Half-moon Cay, Roatan, Bonacca, Curacao and Bonaire, on the other hand, appear to contain nothing but depauperate representations of nearby mainland faunas. This is in accord with the boundaries observed by Allen (1911) and by Bond (1956) for birds. Whether other groups of animals will present a similar picture remains to be seen. The herpetofauna of San Andreas and Providencia, for instance, appears to have much stronger mainland affinities than does the mammalian fauna (see Dunn and Saxe, 1950). As far as mammals and birds are concerned, however, the western and southwestern limits of the Antillean subregion seem reasonably clear.

I wish to acknowledge the help of E. Raymond Hall and J. Knox Jones, Jr., of the University of Kansas Museum of Natural History, and of Philip Hershkovitz and D. Dwight Davis of the Chicago Natural History Museum, for making available material in their care and for other courtesies. I also wish to thank Ernest E. Williams of the Museum of Comparative Zoology, Harvard University, for helpful discussion of this topic.

LITERATURE CITED

Allen, G. M. 1911. Mammals of the West Indies. Bull. Mus. Comp. Zool., 54: 175–263.

Andersen, K. 1908. A monograph of the Chiropteran genera *Uroderma, Enchisthenes,* and *Artibeus.* Proc. Zool. Soc. London, 1908: 204–316.

Bond, J. 1956. Checklist of the Birds of the West Indies. Acad. Nat. Sci. Phila.; 214 pp.

Dalquest, W. W. 1950. The genera of the Chiropteran family Natalidae. Jour. Mamm., 31:436–443.

de la Torre, L. 1955. Bats from Guerrero, Jalisco, and Oaxaca, Mexico. Fieldiana, Zool., 37: 695–701.

Dunn, E. R. and L. H. Saxe, Jr. 1950. Results of the Catherwood Chaplin West Indies Expedition, 1948. Part V. Amphibians and reptiles of San Andreas and Providencia. Proc. Acad. Nat. Sci. Phila., 102: 141–165.

Gaumer, E. A. 1917. Monografía de los mamíferos de Yucatan. Mexico, D. F.: Dept. de Talleres Graficos de la Secretaria de Fomento; 330 pp.

Goldman, E. A. 1911. Three new mammals from Central and South America. Proc. Biol. Soc. Wash., 24: 237–239.

———. 1914. A new bat of the genus Mimon from Mexico. Proc. Biol. Soc. Wash., 27: 75–76.

Hershkovitz, P. 1949. Mammals of northern Colombia. Preliminary report No. 5: Bats (Chiroptera). Proc. U.S. Nat. Mus., 99: 229–454.

———. 1950. Mammals of northern Colombia. Preliminary report No. 6: Rabbits (Leporidae), with notes on the classification of the South American forms. Proc. U.S. Nat. Mus., 100: 327–375.

———. 1951. Mammals from British Honduras, Mexico, Jamaica and Haiti. Fieldiana, Zool., 31: 547–569.

———. 1958. A geographic classification of Neotropical mammals. Fieldiana, Zool., 36: 583–620.

Hoffmeister, D. F. 1957. Review of the long-nosed bats of the genus *Leptonycteris.* Jour. Mamm., 38: 454–461.

Hummelinck, P. W. 1940. Studies on the fauna of Curacao, Aruba, Bonaire and the Venezuelan islands. Utrecht, 130 pp., 16 pls.

KOOPMAN, K. F. 1958. Land bridges and ecology in bat distribution on islands off the northern coast of South America. Evolution, 12: 429–439.

———, M. K. HECHT AND E. LEDECKY-JANECEK. 1957. Notes on the mammals of the Bahamas with special reference to the bats. Jour. Mamm., 38: 164–174.

——— AND P. S. MARTIN. 1959. Subfossil mammals from the Gómez-Farías region and the tropical gradient of eastern Mexico. Jour. Mamm., 40: 1–12.

MERRIAM, C. H. 1901. Six new mammals from Cozumel Island, Yucatan. Proc. Biol. Soc. Wash., 14: 99–104.

MILLER, G. S. 1900. Three new bats from the island of Curacao. Proc. Biol. Soc. Wash., 13: 123–127.

——— AND G. M. ALLEN. 1928. The American bats of the genera Myotis and Pizonyx U.S. Nat. Mus. Bull., 144: 1–228.

——— AND R. KELLOGG. 1955. List of North American Recent mammals. U.S. Nat. Mus. Bull., 205: 1–954.

RABB, G. B. AND E. B. HAYDEN. 1957. The Van Voast–American Museum of Natural History Bahama Islands Expedition. Amer. Mus. Novitates, 1836: 1–53.

THOMAS, O. 1888. List of mammals obtained by Mr. G. F. Gaumer on Cozumel and Ruatan Islands, Gulf of Honduras. Proc. Zool. Soc. London, 1888: 129.

———. 1901. New insular forms of Nasua and Dasyprocta. Ann. Mag. Nat. Hist., ser. 7, 8: 271–273.

The Academy of Natural Sciences of Philadelphia, Philadelphia 3, Penna. Received September 25, 1957.

THE USE OF RADIOLABELING IN DETERMINING PREY-PREDATOR RELATIONSHIPS

BY DENNY G. CONSTANTINE, JENS A. JENSEN AND ERNEST S. TIERKEL

Investigations of epizootiological aspects of zoonotic diseases, such as rabies, necessarily require consideration of prey-predator relationships. Currently used techniques for obtaining this information are in most cases tedious and require massive collections of predators. Examination of gastrointestinal contents of a large collection of predators may be expected to produce negative results if contact frequency between predator and prey is particularly low, and chances of direct observation of predation are similarly reduced. A low frequency of predation may be considered of minor significance in general biological studies, but it may be of primary importance in epizootiological investigations. This point, being a subject of great interest in the rabies problem, led to efforts to devise improved methods for its demonstration. The results of preliminary investigations suggest that a radiolabeling method, described below, may be used as an aid in solving this type of problem. This method is to be tested in the field at a later date, but preliminary results are presented here in order that the technique may receive the early attention of other workers with similar problems.

THEORY AND METHODS

The specific problem inspiring this study was that of determining whether or not bats constitute a portion of the diet of certain carnivores in particular areas. We proposed to determine this by the intraperitoneal inoculation of minute doses of Phosphorus-32 into the individual members of bat colonies, then allowing one week for predation to occur, followed by capture and inspection of suspected bat predators. The latter would be examined for absorbed radioactive phosphorus by simple exterior inspection with a Geiger counter. It was believed that the time lapse would increase chances of detection of predation by permitting radioexamination of a great number of meals per predator. Further, to permit a practical time period for capturing predators, the latter would have to remain radioactive for at least a week following ingestion of the radioactive bats. Several laboratory experiments were conducted, using test bats fed on mealworms and maintained in separate ice-cream carton cages, which were replaced daily. Test carnivores were fed commercial dog food and kept in separate cages, which were cleansed daily.

EXPERIMENTS AND RESULTS

Ingestion 24 hours postinoculation.—Five gray foxes, *Urocyon cinereoargenteus,* were each fed individual bats, *Myotis grisescens,* 24 hours after the bats had received intraperitoneal injections of P-32. Each bat had received a different dose in millicuries as follows: 0.01, 0.05, 0.10, 0.20, and 0.40. The corresponding foxes were radioactive, as determined by Geiger counter detection, for the following numbers of days, respectively: 14, 25, 32 (when fox died), 32 and 47. Two raccoons, *Procyon lotor,* were each fed one *Myotis grisescens,* similarly inoculated 24 hours before with individual doses of 0.01 and 0.40 mc P-32. The raccoons were radioactive for 14 and 40 days, respectively.

Ingestion 8 days postinoculation.—Nine free-tailed bats, *Tadarida brasiliensis,* were divided into two groups and injected as follows: 4 bats, 0.01 mc; 5 bats, 0.10 mc. Eight days later, after being kept active in an environmental temperature of 75°F., each bat was fed to a different carnivore. Two gray foxes and two raccoons ingested the bats receiving doses of 0.01 mc, and two gray foxes, two raccoons and one striped skunk, *Mephitis mephitis,* ingested the bats receiving doses of 0.10 mc. All carnivores were still radioactive seven days after eating the bats. After this time, mechanical failure prevented further use of the detection equipment, so the exact duration of radioactivity in the carnivores was not determined.

Effect of metabolic rate on phosphorus retention.—Six *Myotis grisescens* were each inoculated with 0.01 mc P-32, and five of the bats were induced to hibernate by placing them in a refrigerator where the temperature was 40°F. The remaining bat was kept active in an environmental temperature of 75°F. At the end of 20 days, the single active bat was still noticeably radioactive, and it was placed in a cage with a fox as part of another test. The fox killed the

bat but did not eat it. At the end of 30 days, the hibernating bats were still extremely radioactive, the only loss of P-32 being through radioactive decay and in a few drops of urine on the bottom of the cages. The experiment was discontinued at that time.

DISCUSSION

A first impression of the foregoing data suggests that the radiolabeling technique should satisfactorily serve the purpose for which it was devised. However, it is appropriate that consideration be given to certain possible sources of error before these data are accepted at face value and expected to withstand the forces of field conditions. Duration of retention of P-32 may be expected to be affected by metabolic activity of both prey and predator; also, test animals were maintained under artificial circumstances, quite possibly imposing abnormal metabolic regimes and rates. Thus, negative findings may not be entirely conclusive. This question may be partially answered by feeding bats, recaptured one week after injection, to recently captured carnivores, which would be released in a large but confined natural area and later recaptured. One must also consider the possibility of self-contamination by radioactive feces, urine and saliva in test animals, and of cross-contamination in nature. Feces, urine, saliva and blood of test animals were radioactive. Cages were scrubbed daily, but it is certain that some exterior self-contamination occurred. However, in each case, radiation was last detectable in the upper flank area of carnivores, when excreta were no longer radioactive. A predator "chain" could conceivably give rise to error, so positive findings may not be entirely conclusive. One might conclude that realization of these possible shortcomings tends to bring us back to the old techniques. Indeed, the operation could be advantageously implemented by a combination of radiodetection and autopsy confirmation. This method would markedly reduce the time investment required for blind examination of gastrointestinal contents. Radiodetection by itself should provide, at the least, an invaluable clue, though it may not be conclusive.

SUMMARY

Radioactive Phosphorus-32 was injected into bats and the bats were fed to carnivores. Duration of retention of absorbed phosphorus in carnivores was proportional to doses administered to bats. Carnivores eating bats injected eight days earlier were radioactive at least one week later. Limited evidence suggests that lowered metabolic rate in bats decreases phosphorus elimination. The use of radiolabeling in determining prey-predator relationships is discussed, and possible sources of error are considered.

Communicable Disease Center, U. S. Public Health Service, Atlanta, Georgia. *Received July 5, 1957.*

GENERAL NOTES

AN UNUSUALLY LARGE NEST OF *CRYPTOTIS PARVA*

On January 7, 1958, Bruce Bradshaw and Kenneth Pair reported a nest of shrews containing an unusually large number of individuals. This nest was located four miles east of Nacogdoches, Nacogdoches County, Texas. I immediately went to the area and found the nest under a small oak log on a gently sloping hillside in an open field. This field was sparsely covered with herbaceous vegetation consisting mostly of needlegrass (*Aristida* sp.), doveweed (*Croton* sp.) and small scattered clumps of *Andropogon virginicus*.

The log was about 22 feet long, approximately 8 inches in diameter, and in contact with the ground throughout its length. When the log was gently rolled over the shrew nest could be seen in the middle of the contact area. The nest was composed of leaves and grass and was more or less closed over at the top. The nest was prodded gently and, at each prod, one or two shrews ran out; the first ten were collected. Continued prodding evicted at least 21 more shrews that we were able to count and it is possible that one or two more escaped detection in the grassy surroundings. The occurrence of 31 individuals of *Cryptotis parva* in one nest seems very unusual; the largest number of this species reported previously in one nest was 12 (Davis and Joeris, Jour. Mamm., 26: 136–138, 1945).

The nest occupied a small depression about 2 inches deep and 4 × 6 inches in its lateral measurements. There were no extensive runways or tunnels leading from the nest. Immediately adjacent to the nest and under the log was a pile of fecal droppings about ½ inch high and 4 × 6 inches in extent. Such an accumulation of feces indicated that the shrews, or at least part of them, had occupied this site for a considerable time. All individuals present were either adults or near adults and there was no evidence that they were not living there congenially.

The nest was more or less destroyed by the time we had evicted all the shrews, but the nest material was replaced and the log rolled back. The site was visited again on the afternoon of January 8, at which time only six shrews were living in the nest. The nest, however, had been re-formed to a smaller size.

For about two weeks prior to the finding of the nest, the weather had been somewhat colder than normal for this part of eastern Texas at this time of year. The temperature at night had consistently dropped to around 32°F. It seems probable that these 31 individuals had formed this large colony in order to share body heat, thus counteracting the effect of the prevailing cool temperatures.—W. H. McCarley, *Dept. of Biology, Stephen F. Austin State College, Nacogdoches, Texas.* *Received January 18, 1958.*

POPULATION STRUCTURE IN *BLARINA* AT ITHACA, NEW YORK

During a study of the movements of dye-marked small mammals, areas under investigation were completely snap-trapped at the end of the summer in 1955 and 1956. This note reports an unusually high population of short-tailed shrews, *Blarina brevicauda*, and presents additional information obtained in this study.

McGowan's Woods, a second growth, mixed hardwood stand approximately 50 years old, is an isolated woodlot of 23.8 acres. The Airport Field, located 5 miles northeast of Ithaca, New York, is a plot of about 10.7 acres. The field was in pasture some time prior to 1950 and is poorly drained.

A 50-foot grid was established on both areas. Half of a wax-coated quart milk container was baited with rolled oats and placed at each station. The boxes served as protection for the bait and as receptacles for feces. Visitation, as evidenced by deposition of scats, was recorded by species. In October of 1955 both areas were snap-trapped; the traps were placed in the bait boxes with the trigger directed out. Only McGowan's Woods was snap-trapped in July, 1956.

All shrews were sexed by internal examination and the reproductive condition of each was noted. Each animal was examined at the same time for tooth wear, using the criteria described by Pearson (Amer. Midl. Nat., 34: 531–546, 1945) and Pruitt (Amer. Midl. Nat., 52: 236–241, 1954). The individuals were grouped according to their reproductive status or other features besides tooth wear used to age shrews.

The following information summarizes the data for aging *Blarina* based on tooth wear. Figures in parentheses indicate the number of individuals having the particular degree of tooth wear indicated by the figure preceding.

Airport Field, 1955.—Adult males: 5(1); young males: 2(6), 2½(1), 3(10), 3½(1); adult females: 3(1); young females: 2(3), 2½(3), 3(10), 3½(1); sex unknown: 3(1). Total: 38.

McGowan's Woods, 1955.—Adult males: 6(1); young males: 1(1), 3(20), 3½(6), 4(1); adult females: 3½(2), 4(1), 6(2); young females: 2(3), 2½(1), 3(23), 3½(3), 4(3). Total: 67.

McGowan's Woods, 1956.—Adult males: 2½(1), 3(2), 3½(1), 5(2), 5½(1), 6(2), 7(2); young males: 1(4), 1½(22), 2(40), 2½(11), 3(15), 4(1); adult females: 2(4), 2½(4), 3(10), 4(2), 4½(4), 5(3), 5½(6), 6(2); young females: 1(4), 1½(19), 2(30), 2½(9), 3(1); sex unknown: 1½(3), 2(2). Total: 207.

The adult male *Blarina* taken at the Airport Field (1955) had regressed testes, while the adult female also taken in this area had placental scars. No other females appeared to have bred during the season. At McGowan's Woods (1955) the adult male *Blarina* had regressed testes and all but one adult female (Age Group 6) had placental scars. It seems likely that some females in Age Group 3 at both the Airport Field and McGowan's Woods (1955) had bred once during the season, but all reproductive evidence had disappeared by the trapping period. Certainly some very young shrews were breeding early in July in McGowan's Woods (1956). The tooth wear criteria indicated by Pearson and Pruitt are subjective estimates. Intermediate values are used because there are no clear-cut divisions between the age groups, and certain skulls seem best assigned to these values. Fewer age groups certainly would serve to separate the population as well as the seven groups suggested by Pearson (*op. cit.*). The effect of different foods on tooth wear has not been investigated so it would be difficult to state that the age groups assigned to the shrews in the field as opposed to those in the woods represent the same absolute age.

All populations were considered susceptible to trapping because, for a period of 1–2 months prior to snap-trapping, boxes had been baited regularly. On both areas, and in each year, the sex ratio was essentially the same. The normal population drop-off took place during the trapping period, with the sexes equally distributed each day. It should be noted that at the Airport Field, 38 *Blarina* were trapped on 10.7 acres, while at McGowan's Woods (1955), 67 were trapped on 6.3 acres. In 1956, at McGowan's Woods, 207 shrews were trapped and 88 of these were taken from the same 6.3-acre area used in 1955. In three days, August 18–20, 127 shrews were trapped on 16 acres. From August 3–13, 71 shrews were taken; and 9 animals were caught after August 20. For at least two years the shrew population remained at a very high level in the woods. Reproductive evidence indicates that five of the older adult females taken in 1956 were carrying young while nursing litters born earlier in the season. Those adult females not carrying young were nursing. Fifty-six per cent of the females were breeding as opposed to 12 per cent of the males. These differences are highly significant. Evidence of this high shrew population was suspected prior to snap-trapping because most stations had bait removed daily.—JOHN G. NEW, *Science Dept., State University Teachers College, Oneonta, New York.* *Received January 27, 1958.*

CAUSES OF MORTALITY IN SHORT-TAILED SHREWS

Many authors have commented on the high mortality rate of shrews during live-trapping studies. Blair (Ecology, 21: 284–288, 1940; Amer. Midl. Nat., 25: 681–685, 1941) particularly

noted the heavy mortality on the first night of trapping which ranged between 25 and 40 per cent. In population studies of shrews, such losses would invalidate the conclusions.

The suggested cause of shrew mortality has been partially summarized by Pearson (Amer. Midl. Nat., 34: 531–546, 1945) and ascribed to such factors as hunger, thirst, cold, predation, internal parasites, intraspecific conflict, fear, thunder storms and old age. Orr (Jour. Mamm., 30: 195–196, 1949) suggested that two long-tailed shrews he caught had died of fright. In both instances the shrews were confined to rather small quarters.

The following observations were made in the field during the summer and fall of 1955 and 1956 in the Ithaca, New York, region. Field work was supported in part by New York State Honoraria granted by the New York State Science Service. The author is grateful for this financial support. A live-trapping program to dye-mark small mammals was in progress. Single-catch, ¼-inch wire-mesh live traps measuring 12 × 3 × 3 inches and manufactured by the Young's Animal Trap Company were in use.

An effort was made to shield traps from the sun and to keep them ventilated. Canned dog food was used as bait and there was always an ample supply in the trap. Water was not supplied, though in the one instance when a shrew was brought into the laboratory unharmed and confined in a live trap with both food and water, it died during the day.

I had the opportunity of observing shrew behavior shortly after the animals entered the trap. An escape pattern was evident in four shrews. In two instances the shrews remained almost motionless and consumed much of the bait. They continued to feed even when the trap was picked up for closer observation. When disturbed further they ceased feeding and started to move around the trap, seeking the exit. The other two shrews showed the escape pattern when first observed. In all cases the shrews were frantic in their efforts to escape. They continually sniffed and probed the openings in the wire mesh. They moved incessantly and did not feed. These animals were released to prevent disturbance of the work already accomplished.

In two other instances shrews were found in the trap alive but lying on their sides in convulsive fits. The feet were held close to the body. Respiratory movements appeared irregular and spasmodic. One animal died shortly thereafter and the other was placed by a burrow entrance near the trap. An hour later it was dead. Efforts to stand the animal on its feet had failed, and both animals appeared unable to crawl or regain their balance. These symptoms suggest hypoglycemia as the cause of death.

Christian (Jour. Mamm., 31: 247–259, 1950) has discussed the "shock disease" syndrome in connection with population cycles in mammals. It is probable that shrews confined to small quarters are under conditions of stress especially when thwarted in their efforts to escape. This may bring about derangement of the adreno-pituitary system resulting in the conditions described above. The rapidity with which this system functions has not been clarified. Recently, Buckner (Jour. Mamm., 38: 89, 1957) has shown that the addition of Chlorpromazine to the bait reduced mortality substantially in long-tailed shrews. In order to prevent shrew mortality in live-trapping I visited traps every 4 hours. Even this period was too long in some instances. Two-hour intervals would probably be best. Pearson (*op. cit.*) noted that there were many deaths when traps were visited at 6-hour intervals. In some of the observations reported above, it is likely that the shrews had just entered the traps and begun to feed. Those instances resulting in death were observed at the end of the 4-hour interval.—John G. New, *Science Dept., State University Teachers College, Oneonta, New York.* *Received January 27, 1958.*

AMERICAN BATS REPORTED IN ICELAND

In the most recent comprehensive review of the mammals of Iceland, that of Saemundsson and Degerbøl (1939), there is no mention of any bat having been recorded on the island. It is therefore of special interest, particularly to North American mammalogists, to know that since that date there have been three recorded occurrences of bats in Iceland, and that in each case the species concerned was North American.

The purpose of the present note is to draw attention, in English, to these discoveries, in a medium of wider circulation than that in which they were first reported, especially in view of the fact that the first two reports have not been listed in the Zoological Record.

The first report, by Gudmundsson (1943), describes how a bat identified as *Lasiurus cinereus* was captured at Hvall in Myrdalur on October 14, 1943. The second report, also by Gudmundsson (1944), describes a bat identified as "*Vespertilio gryphus* F. Cuv." or "The Little Brown Bat" (presumably *Myotis lucifugus*) as having been found by the harbor at Reykjavik on August 23, 1944. The third specimen was also reported by Gudmundsson (1957); it was found in a field at Selvogur on October 8, 1957, alive but wet and exhausted. It was identified as *Lasiurus cinereus*.

Gudmundsson (1957) comments that there is a possibility that these bats may have been carried from the eastern United States or the Gulf of St. Lawrence (the nearest points of their normal distribution) by ships or even by aircraft. On the other hand, he instances the numerous cases of American birds reported in Iceland as favoring the view that the bats may have reached Iceland without human aid, storm-blown while on migration. Gudmundsson states that the weather during the days preceding the discovery of the Selvogur *Lasiurus* was such that the latter supposition seemed quite likely. It is well known that *Lasiurus cinereus*, the hoary bat, is a strong-flying migratory species which has been frequently noted flying southward in autumn along the Atlantic coasts of the United States, sometimes well out to sea. There are also several records of its occurrence in Bermuda, 666 miles from the nearest land.

Whatever the true explanation of these Icelandic occurrences, the facts deserve to be better known.— R.W. Hayman, *Dept. of Zoology, British Museum (Natural History), London, S.W. 7. Received February 14, 1958.*

LITERATURE CITED

Gudmundsson, F. 1943. Ledurblökuheimsóknin. Natturufraedingurinn, Reykjavik, 13: 153–154, 1 fig.

———. 1944. Ný ledurblökuheimsókn. Natturufraedingurinn, Reykjavik, 14: 143.

———. 1957. Ledurblaka handsomuo i Selvogi. Natturufraedingurinn, Reykjavik, 27: 143–144, 1 fig.

Saemundsson, B. and Degerbøl, M. 1939. Mammalia *in* The Zoology of Iceland, 4, pt. 76: 1–52. Copenhagen.

THE EVENING BAT IN NEBRASKA

On the night of June 1, 1957, we obtained two evening bats, *Nycticeius humeralis humeralis*, at a locality 2 mi. N and 2 mi. E of Bellwood, Butler Co., Nebraska. On the evening of June 29, 1957, we collected two more of these bats at the same locality. These specimens provide the first record of occurrence of the species in Nebraska and extend the known range of *N. h. humeralis* approximately 140 miles northward from 6 mi. SW Clay Center, Kansas (see Cockrum, Mammals of Kansas, Univ. Kansas Publ., Mus. Nat. Hist., 7: 73, 1952). Two of the bats are now in the collection of the Museum of Natural History, University of Kansas (KU 73206, 73207), and two are in the collection of the University of Nebraska State Museum (UNSM 12000, 12001).

The four bats, all adult females, were shot at dusk as they foraged approximately 15 feet above the surface of a narrow arm of a sand pit lake in the Platte River floodplain. Other bats that we judged to be *Nycticeius* were seen on both evenings as they foraged among trees that bordered the lake; frequently two or three were seen together. The Platte River floodplain supports continuous riparian growth in this area, mainly cottonwoods (*Populus deltoides*); we noted hollows in the trunks of many of the larger trees.

Each of the two specimens obtained on June 1 contained two embryos. Average and extreme external measurements of the four bats are as follows: Total length, 94.0 (92–96);

length of tail vertebrae, 36.2 (35–39); length of hind foot, 8.5 (8–9); length of ear from notch, 13.2 (13–14) mm. The two non-pregnant females weighed 12.4 and 12.5 grams. —J. KNOX JONES, JR. AND TERRY A. VAUGHAN, *Museum of Natural History, Univ. of Kansas, Lawrence. Received January 16, 1958.*

RELATIONSHIP BETWEEN AGE AT SEPARATION AND SUBSEQUENT BREEDING PERFORMANCE OF GROWING MALE MINK

For a number of economic reasons, it is a common practice among mink ranchers to leave the litters together most of the summer. In the early fall, when the kits are from 12 to 18 weeks old, they are separated and placed in individual pens. At the U.S. Fur Animal Experiment Station it has been the general procedure to separate the kits when they are weaned at six weeks of age and start them on feeding experiments immediately. This practice has been justified since male mink have about 60 per cent of their total growth at 11 weeks of age and over 78 per cent at 16 weeks. Quite obviously, it is of the utmost importance for the experimentalist, concerned with critical nutritional problems of growing mink, to wean, separate and start such animals on experiment at as early an age as possible.

At this station, more than half the male kits which were kept over as breeding-herd replacements proved to be nonaggressive, ineffectual breeders. Mink ranchers normally expect from 85 to 90 per cent of their male kits to be active. This general lack of aggressiveness and interest on the part of our young males raised a question as to the relationship between early separation and subsequent breeding performance. Enders (Proc. Amer. Phil. Soc., 96: 691, 1952) raised the question of the relationship between age at separation and activity of male kits during their first breeding season. In a later publication (Natl. Fur News, Jan. 1956, p. 8) he credits Leonard and Bowness with first suggesting that the time of separation may be important in the breeding performance of young males. In an attempt to obtain some data on this problem, the following experiment was conducted.

Experimental procedure.—Thirty-one male kits were used in this study in 1955–56 and 28 in 1956–57. All animals were weaned at six weeks of age. In each year's study, half the total animals were placed in separate pens immediately after weaning. The remaining animals were placed three or four to a pen and left together until they were 11 weeks of age, when they too were placed in individual cages. Animals were fed a diet containing 70 per cent fresh animal products, 12 per cent cereal and 18 per cent water until they were 11 weeks old. One-half of the animal products was horsemeat. After the kits reached 11 weeks of age, their diets were varied in 1955–56, but in 1956–57 all were continued on the same feed.

Mating began on March 10 in both years. Pairings for mating were at random between males and females of similar fur quality, with the restriction that no closely related animals

TABLE 1.—*A comparison of the matings completed by males separated at either 6 or 11 weeks of age*

YEAR	AGE AT SEPARATION	NUMBER OF ANIMALS	INITIAL OPPORTUNITIES*			TOTAL OPPORTUNITIES†	
			Number	Matings	Males mating	Number	Matings
1955–56	6 weeks	15	60	4	4	118	9
	11 weeks	16	64	14‡	10	292	58‡
1956–57	6 weeks	14	70	4	2	126	9
	11 weeks	14	70	27‡	12	266	64‡

* 4 trials per male in 1956, 5 in 1957.
† During the entire breeding season.
‡ Significantly different at the 1 per cent level of probability.

were mated. In 1955–56 the experimental males were used at random during the first two to three weeks of the breeding season. The number of matings completed after four pairings was used for evaluating the experimental treatments.

In 1956–57 the mating plan was further refined. Each of the males in the two experimental groups was allowed a female per day on the first five days after March 9. None of the females had previously been paired during the current mating season. The number of adult and yearling females was equally distributed between the two treatments. In order to stimulate the male kits, adult males not on experiment were allowed an opportunity on March 9 to mate in pens close to those occupied by the young males.

Results and discussion.—The results of the tests are shown in Table 1. It is quite apparent that those males separated at 11 weeks of age were more active, in that they had significantly more matings than those separated at six weeks. In both years, males separated at six weeks had a total of only four matings out of 60 and 70 opportunities, respectively. This total does not tell the whole story, since three of the four 1957 matings were made by one male. This difference in favor of the 11-week group was highly significant statistically for both years ($P<0.01$).

It was of interest to note the results of the total mating activity of both groups during the entire breeding seasons of 1956 and 1957. This comparison is not exactly equitable since the number of total opportunities was in part a result of the past performance of the kit and thus is biased in favor of the 11-week group. The greater activity of the 11-week group is still marked, however.

These results clearly indicate that under the conditions of this experiment the age of separation has a marked effect on the subsequent breeding performance of male mink kits. —Charles F. Bassett, Hugh F. Travis, R. P. Abernathy and R. G. Warner, *U.S. Fur Animal Exp. Sta.* and *Dept. of Animal Husbandry, Cornell Univ., Ithaca, New York.* (Travis' present address: *Dept. of Poultry Husbandry, Michigan State Univ., East Lansing.*) *Received December 18, 1957.*

HISTORICAL NOTE ON THE BAHAMA RACCOON

In view of Sherman's record (Jour. Mamm., 35: 126, 1954) of an extremely successful recent introduction of the raccoon (*Procyon lotor*) into Grand Bahama, it is interesting to note that a reliable German naturalist and surgeon, Johann David Schoepf, apparently received information in 1784 that the raccoons now found on New Providence Island are also human introductions. After a visit there in the spring of 1784, he wrote:

> Of wild quadrupeds there are but two species, properly only one, indigenous to these islands. The *Racoon* is found only on Providence Island, of which it is no more originally a native than the rats and mice brought in by ships. From one or more tame pairs of these droll beasts, brought over by the curious from the main-land, and afterwards escaped by chance into the woods, the race has amazingly increased, to the great vexation and damage of the inhabitants, who can scarcely protect their house-fowls from these stealthy thieves. (*Travels in the Confederation* [1783–1784]; transl. by A. J. Morrison. Philadelphia, W. J. Campbell Co., 1911, vol. 2: 289.)

Although Bangs (Proc. Biol. Soc. Wash., 12: 91–92, 1898) erected a new species (*P. maynardi*) after the examination of a young male and two captive females from New Providence Island, understanding that no tradition of human introduction existed, Miller ("Mammals of the Bahama Islands," pp. 371–384 *in* The Bahama Islands, ed. by G. B. Shattuck, Geogr. Soc. Baltimore, 1905) heard in 1903 that most informants believed raccoons had been introduced at some very early date. Miller (*op. cit.*, p. 377) noted that C. J. Maynard, who brought the animal to the attention of Bangs, had known of its existence since 1884.

All observers agreed that it was found only on New Providence; later taxonomists, including Goldman (North Amer. Fauna, 60: 76, 1950), have generally accepted the validity of

P. maynardi. But Koopman, Hecht and Ledecky-Janecek (Jour. Mamm., 38: 164, 1957), on the basis of a larger series of specimens than previously available to reviewers, doubt that *maynardi* is a sound species, considering it only an island subspecies of *P. lotor*.

Simpson (Amer. Mus. Novitates, 1759: 8, 1956) accepts the Bahama raccoon as an example of a legitimate rafting from the mainland. Historical research may furnish a more immediate answer, in this particular case. Since Sherman shows that successful introductions of raccoons can take place, and Koopman *et al.* object to *maynardi* as a full species, it may be suggested that Schoepf visited the Bahamas soon after the establishment of the raccoon population there.—DANIEL MCKINLEY, *Dept. of Biology, Bowdoin College, Brunswick, Maine. Received January 29, 1958.*

AGE RATIOS IN RACCOONS

An earlier publication (Petrides, Amer. Midl. Nat., 43: 355–382, 1950) advised of the probable value of X-ray pictures in separating young raccoons of the year from older animals. A study of X rays and skeletal material of raccoons of known age from the Ohio State Raccoon Farm will be reported more completely at some future date. Meanwhile, biologists may be assisted by the knowledge that young raccoons in their first winter definitely can be identified as such where X rays of the distal ends of the radius and ulna disclose the epiphyses to be distinct and not fused with the shafts of those bones. Animals in their second and subsequent winters have epiphyses joined with the diaphyses.

This age criterion should be particularly helpful in population studies of this species since not all females breed at the end of their first year (Stuewer, Ecol. Monogr., 13: 203–258, 1943); hence teat-size observations (Petrides, *op. cit.*) yield only breeding : non-breeding ratios. X-ray pictures of the paws of the non-breeding females should disclose the proportion of young of the year in that group, and comparisons with teat size also should indicate the extent of non-breeding among older females. Either paw X rays or baculum collections (Petrides, *op. cit.*; Sanderson, Jour. Wildl. Mgt., 14: 389–402, 1950) should yield suitable age ratios in male raccoons.—GEORGE A. PETRIDES, *Depts. of Fisheries & Wildlife and Zoology, Michigan State Univ., East Lansing. Received December 9, 1957.*

FOOD STORAGE BY A KANGAROO RAT

A female Pacific kangaroo rat (*Dipodomys agilis*) escaped from its cage in the behavior laboratory at Michigan State University sometime after midnight of October 24, 1957, and was discovered in a corner about 1:00 PM the following afternoon. The area where the food was stored measured 7 × 12 inches. A stack of three cardboard boxes occupied the space in the immediate foreground, but there was no covering over the animal although there were other places in the room which provided more cover.

The individual made an opening 3 inches long near the base of a 10-pound paper sack of sunflower seeds, and from this rip the food was taken. The animal had carried the seeds to the opposite corner of the laboratory about 21 feet away. There were only four seeds which had spilled out of the rip and remained next to the sack of sunflower seeds.

The kangaroo rat had transported a total of at least 3,640 sunflower seeds from the bag to the corner; this number was probably even greater as indicated by the presence of empty husks in the pile of seeds. Of the above number, 129 were husked and remained mixed with the main storage pile, and 34 more were in a separate group.

In addition to the sunflower seeds there were 14 husked wheat grains which had apparently been picked up from the floor, since there were no other types of seeds in the sack of sunflower seeds. There were also bits of cardboard from paper matches which had been chewed into small pieces, as well as a ball of cotton and three small wads of dust. There were 19 fecal pellets mixed in the main storage pile, and 10 pellets with the sorted husked sunflower seeds.

The total weight of the seeds was 298 grams—enough to fill a one-pound coffee can. The kangaroo rat weighed 58 grams, and thus carried about six times its own weight in food. This particular individual carries about 30 seeds at one time in its pouches, although I have counted as many as 39. On the basis of 30 seeds per trip, this one made about 115 round trips; this would total 4,830 feet if it traveled back and forth in a straight line.

For obvious reasons the "operation" was terminated at the time of discovery, and the kangaroo rat was returned to its cage. There was, however, no indication that the storing process had ceased since it was still carrying seeds in its pouches when it was discovered. —Robert D. Burns, *Dept. of Zoology, Michigan State Univ., E. Lansing. Received February 26, 1958.*

NEW NORTHERN RECORD FOR *LEPUS ALLENI* IN ARIZONA

On January 12, 1958 an adult female antelope jack rabbit (*Lepus alleni*) was collected 6½ miles south of Apache Junction, T. 1 S, R. 8 E, Sec. 34, Pinal County, Arizona, at an elevation of 1,800 feet. Its measurements were: length, 635; tail, 50.5; hindfoot, 140; ear from notch, 172 mm. Pregnant with 3 small embryos, this animal weighed 9½ pounds. The specimen was sent to the Museum of Natural History at the University of Illinois.

Two other jack rabbits of this species were seen at this locality on the same day, and the hide of another was found at a stock pond. A specimen from Casa Grande in the U.S. National Museum was the northernmost record for *Lepus alleni* in Arizona. However, this new record places the species approximately 28 air miles north of that locality.—Norman G. Woolsey, *Arizona State Game & Fish Dept., Mesa, Ariz. Received January 20, 1958.*

REINGESTION BY THE SNOWSHOE HARE

The recent paper by Lechleitner (Jour. Mamm. 38: 481–485, 1957) disclosed that there are only two published records of reingestion by American lagomorphs. Geis (Jour. Mamm. 38: 136, 1957) has recorded coprophagy in the cottontail rabbit. The lack of any record of this phenomenon in the snowshoe hare, *Lepus americanus*, has prompted me to report the following observations. While investigating the occurrence of helminth parasites of hares collected in the Upper Peninsula of Michigan, I recovered a total of three fecal pellets from the stomach of one hare. These pellets were loosely formed, but their identity was unmistakable. The contents of the stomach were not measured but were believed not to have exceeded 10 cc. This lack of an appreciable amount of food in the stomach facilitated detection of the pellets. A total of 565 stomach worms, *Obeliscoides cuniculi* (Graybill), also were recovered from the stomach. The hare, an adult male, was killed at 3:30 PM on June 2, 1957, in Iron County, Michigan.—Theodore A. Bookhout, *Michigan Dept. of Conservation, Shingleton. Received January 11, 1958.*

ANOTHER RECORD OF COPROPHAGY BY THE COTTONTAIL

Kirkpatrick (Jour. Mamm., 37: 300, 1956) reported the first case of reingestion (coprophagy) of soft fecal pellets in the cottontail (*Sylvilagus floridanus mearnsi*). A second case, and the first to be based upon stomach analysis, is reported here. On November 23, 1957, an adult female cottontail was shot at Edinburgh, Ohio, about 10:45 AM. Dr. Vincent Gallicchio examined the specimen for parasites and then gave the stomach to the writer for a study of food habits. The stomach was found to contain about 20 cc. of a greenish-yellow mass of finely chewed vegetable matter. Approximately one-third of the mass, at one end of the stomach, consisted of numerous soft fecal pellets. They had been swallowed whole as there was no evidence that any of them had been chewed, and they formed a distinct mass of rounded pellets sharply set off from the other contents. However, the color and texture of the pellet material and of the other food were identical. Dr. Gallicchio found in his dissection about five pellets remaining in the rectum, but did not

note their consistency. Possibly these were also of the type that are reingested and the animal was killed just before the last few were swallowed. The time of day when the animal was killed suggests such an explanation. The subject of reingestion by lagomorphs has recently been reviewed by Lechleitner (Jour. Mamm., 38: 481–485, 1957).—Ralph W. Dexter, *Dept. of Biology, Kent State Univ., Kent, Ohio.* *Received December 9, 1957.*

GIRAFFE INTERGRADATION IN KENYA

Since data concerning the distribution of the species and races of giraffe are scarce, the following observation, which concerns apparent hybrids between the reticulated giraffe (*Giraffa camelopardalis reticulata*) and the Masai giraffe (*G. capensis tippelskirchi*), a race of the southern species, seems noteworthy. The reticulated giraffe inhabits such low-level deserts in Kenya as lie north of the Tana River and east of Lake Rudolph, and also adjacent parts of southern Abyssinia; while the Masai giraffe occurs in deserts, bush country and grasslands in Kenya south of Mt. Kenya, Lake Nakuru, and from the Loita Plains into and throughout the greater part of Tanganyika.

On October 8, 1957, when on safari in Kenya's Northern Frontier Province, Hugh R. Stanton of Kenya, C. Jackson Selsor of California, and I encountered a group of 4 adult giraffes standing in a clump of acacias near the Thika-Garissa road. The locality was south of the Tana, 9 miles by road southwest of Garissa, and within sight of the Tana's gallery forests. When we stopped to examine the giraffes, we found that one specimen had the typical liver-colored hide and the network of narrow white lines of *reticulata*, another the brown "oak leaf" blotches and tawny interspaces of *tippelskirchi*, while the other two animals appeared intermediate between the two forms.

The markings of the last two were more like those of *reticulata*, giving the appearance of having a solid background color broken up by a network of lines, rather than having dark spots against a light background as in *tippelskirchi*. However, the background color was not so reddish as that of the typical *reticulata*, and the reticulation was buffy tan rather than white. Furthermore, the edges of some of the dark areas bore short irregular indentations from the lighter interspaces. Both atypical animals had a marked whitish cast to the head which produced a powdered effect. This head coloration is typical of neither form, the *reticulata* head having a fawn-colored background color and *tippelskirchi* having a brownish or blackish forehead. North of the Tana, between Garissa and Lamu (a distance of roughly 180 miles), we saw great numbers of giraffe, all of which exhibited characteristics typical of *reticulata*.

Similarly, nine years ago along the Maralal-Rumuruti road on the Laikipia Plateau, Stanton showed me giraffe that exhibited characteristics of both *reticulata*, which occurs mainly to the north and east, and the Baringo giraffe (*G. camelopardalis rothschildi*) of the north and west, yet were typical of neither form. Lay residents of both the Laikipia region and the area south of the Tana make colloquial distinction between these apparent hybrids and the "true reticulated."—Ken Stott, Jr., *Natural History Museum, San Diego, Calif.* *Received January 3, 1958.*

FURTHER INCIDENCE OF WHITE-TAILED DEER IN COLORADO

On the afternoon of October 20, 1957, a plains white-tailed deer, *Odocoileus virginianus macrourus*, was killed in Larimer County, Colorado, during the authorized deer season in that vicinity. The young doe was shot by George Wallace Brown of Colorado State University while hunting mule deer in the area. The exact location may be described as Sec. 9, T. 7 N, R. 69 W. This verifies the supposition that while-tailed deer have extended their range to the foothills of the Rocky Mountains in north-central Colorado. The whitetail, once abundant in the state, was believed extirpated a number of years ago. However, on February 28, 1953, a whitetail was killed on a road near the town of Crook in eastern

Colorado. In subsequent years, several reports of white-tailed deer in eastern Colorado have been received and verified, but this incident indicates that re-entry of the state has definitely been accomplished.

At the time of kill, the doe was residing in a stream-bottom type of habitat composed chiefly of willow, cottonwood, snowberry and rabbit brush. A rumen sample analysis disclosed that approximately 95 per cent of the diet consisted of snowberry. A brief pathological examination revealed a minimum of parasites, and the doe appeared to be in good condition. Age was estimated at 16 months.

Appreciation is expressed to Douglas L. Gilbert, Colorado State University, and to personnel of the Colorado State Game and Fish Department, whose assistance in the preparation of this note was invaluable.—Fred A. Harrington, Jr., *Colorado State Univ., Fort Collins.* *Received January 16, 1958.*

RECORD OF AN ANTLERED FEMALE ELK

Records of three antlered female white-tailed deer (*Odocoileus virginianus borealis*) have been reported by Wislocki (Jour. Mamm., 35: 486–495, 1954) who proposed an hypothesis for the occurrence of these malformed, small antlers in which the velvet was retained. Two additional records of antlered female white-tailed deer (*O. v. ochrourus*) and one of an antlered female mule deer (*Odocoileus h. hemionus*) were subsequently reported by Buechner (Jour. Mamm., 38: 277–278, 1957) who agreed with Wislocki's hypothesis.

Since Wislocki suggests placing on record the details of additional antlered female deer, and since it is highly probable that the causes responsible for these anomolous antlers are the same for both deer and elk, the following record is presented. On November 11, 1957, an antlered female elk (*Cervus canadensis*) was shot by Floyd Frost at Grouse Flats, Asotin County, southeast Washington. The one velvet-covered antler, on the left side, measured 470 mm. from base to tip along its outside curve. The antler was without a pedicel and unbranched, but its tip was slightly bifurcated. No other abnormal extrusions occurred on the skull. It was placed in the Charles R. Connor Museum (WSC 57-290). Although this female was not lactating and was not accompanied by a calf at the time she was killed, the appearance of her udder indicated that she had been lactating. A comparison of the molariform teeth with those described for elk by Quimby and Gaab (Jour. Wildl. Mgmt., 21: 435–451, 1957) suggested that this animal was eight years old.

The evidence from this elk parallels that reported for deer by Wislocki and Buechner and is consistent with Wislocki's hypothesis.—Irven O. Buss and J. David Solf, *Department of Zoology, State College of Washington, Pullman.* *Received December 24, 1957.*

ANOTHER ANTLERED FEMALE DEER

The records of three antlered female deer reported by Wislocki (Jour. Mamm., 35: 486–495, 1954), three antlered female deer reported by Buechner (Jour. Mamm., 38: 277–278, 1957) and an antlered female elk reported immediately above provide evidence supporting Wislocki's hypothesis for the occurrence of these anomolous antlers.

The following record of an antlered female deer involves some details which are different from those reported in the accounts cited. On October 7, 1956, an antlered female deer (*Odocoileus h. hemionus*) was shot by Arthur Wilmot about 8 miles west of Roy, Power County, Idaho. The antlers were large, symmetrical and with seven distinct points on each side. Several small spikelike growths occurred near the base of each antler, and two spikes between the antlers had grown directly from the skull. About one-third of the left antler was covered with velvet, whereas the right antler was entirely without velvet. Based on the appearance of the udder, which closely resembled that of a yearling deer, this female had not lactated. Although the uterus, oviducts and ovaries appeared normal, no evidence of a previous pregnancy was found. However, since the corpus luteum of pregnancy

is temporary, the absence of pigmented vestiges of this structure in the ovaries does not preclude previous pregnancy. On the basis of observed wear to the molariform teeth, this deer appeared to be from seven to nine years old.

Although the evidence from this antlered female deer does not support Wislocki's hypothesis, it is not inconsistent with it since the possibility of an early pregnancy cannot be ruled out.—Irven O. Buss, *Dept. of Zoology, State College of Washington, Pullman.* *Received December 24, 1957.*

THE EFFECTS OF FIRE ON THE SMALL MAMMAL POPULATIONS OF CHAPARRAL

Practically no quantitative information is available on the percentage of small mammals killed by forest and brush fires. This is undoubtedly due to the difficulty of setting up a planned trapping program, and the difficulty of determining which animals in a previously censused area were killed rather than forced off beyond the trapping area. To our knowledge the only quantitative data are those of Spencer (Proc. Soc. Amer. Foresters Meeting, 1955: 125–128) who found that a 13-acre slash burn contained only 50 per cent fewer small mammals than an adjacent unburned area during the six days immediately after the fire. The effect of the burning in this case must have been considerably limited by the small area involved.

On January 6, 1957, the writers surveyed part of Lechuza Canyon, within the extensive Malibu area burn in southern California, several days after the fires were out. The moderate slopes of the canyon had been covered by chaparral shrubs; these merged into oaks and sycamores in the canyon bottom which contained a running stream and dirt road. In a transect 1,500 feet by 50 feet (1.7 acres) in the canyon bottom, the following carcasses were easily counted: 28 *Neotoma fuscipes*, 9 *Sylvilagus auduboni*, 2 *Peromyscus* sp., 1 *Microtus* sp., 1 *Mus musculus*, 1 *Didelphis marsupialis*, 1 *Odocoileus hemionus californicus*, and 2 passerine birds. While it is quite possible that some mice were missed, the larger forms were very obvious on the bare soil or ashed litter. Apparently most individuals died of asphyxiation or heat prostration. Only the opossum, one rabbit and the house mouse were charred. The deer was slightly singed, but the other bodies were untouched by fire. Most carcasses were on their backs or sides.

The prefire density of mammals is not known. However, the value for *Neotoma*, 16 carcasses per acre, is almost double that of 8.4 resident *N. fuscipes* per acre, calculated from the data of Linsdale and Tevis (The dusky-footed wood rat, Univ. Calif. Press, pp. 84, 474, 1951) for Long Field, a situation roughly similar to Lechuza Canyon. This indicates that the *Neotoma* kill in the canyon could easily have been complete. The cottontail kill would also appear to be complete. Of course, the interpretation is confounded by the likelihood that some of the 16 rats per acre were flushed into the canyon census area from adjacent areas. However, since the burn was extensive on all sides, some animals also would have been flushed from the census area.

Because of the ease with which postfire carcass counts can be made in chaparral areas, this method merits attention as a means of getting quantitative data on population densities in areas where extensive intense fires have occurred.—Robert M. Chew, Bernard B. Butterworth and Richard Grechman, *Dept. of Biology, Univ. of Southern California, Los Angeles.* *Received January 30, 1958.*

ABUNDANCE OF SMALL MAMMALS IN CONIFER PLANTATIONS

During an evaluation study of coniferous plantations as wildlife habitat (N.Y. State P-R project W-36-R), I had the opportunity to compare the abundance of small mammals present in plantations over 20 feet tall.

Three plantations on State Reforestation Area No. 3, Town of Caroline, Tompkins County, New York, were chosen. These included pure plantings of three species of conifers: jack pine (*Pinus banksiana*), 54 acres; Scotch pine (*Pinus sylvestris*), 22 acres; and larch (*Larix decidua*), 38 acres. These were growing side by side and were all planted in 1939. In addition, the small mammal population was sampled in a balsam fir (*Abies balsamea*) plantation of 10 acres located on a flat 600 feet southwest of the larch.

Both the jack pine and the larch plantations had considerable herbaceous undergrowth. The ground cover in the jack pine was composed mainly of cinquefoil (*Potentilla simplex*), strawberry (*Fragaria virginiana*), aster (*Aster* spp.), goldenrod (*Solidago* spp.), poverty grass (*Danthonia spicata*) and sedge (*Carex* spp.). The ground cover beneath the larch consisted of goldenrod, cinquefoil, bramble (*Rubus* spp.) and moss (predominately *Thuidium* and *Polytrichum*). In both plantations there was little accumulation of needles. Ground cover was sparce to lacking in the Scotch pine and most of the herbaceous vegetation, chiefly bramble, was confined to openings. There was excellent ground cover under most of the balsam fir. This consisted of moss, bramble, goldenrod, aster and poverty grass. The undercover undoubtedly was stimulated by the removal of the lower branches of the balsam.

Trapping areas in each plantation were randomly selected on a cover map. Traps were then set out in grids with stations placed 50 feet apart. The results are summarized in Table 1.

There was a relationship between the small mammal populations and the undergrowth. The larch and jack pine plantations had considerably higher populations of wood mice and short-tailed shrews than the Scotch pine. The two specimens trapped in the latter were taken in small openings with herbaceous growth. Small mammal sign was greater in the larch than in the jack pine and more abundant in the latter than in the Scotch pine.

TABLE 1.—*Catch of small mammals in snap traps, September, 1955*

PLANTATION SPECIES	TRAP NIGHTS	WOODMOUSE, *Peromyscus leucopus*	SHORT-TAILED SHREW, *Blarina brevicauda*
Jack pine	114	5	5
Scotch pine	114	2	0
Larch	114	11	9
Balsam	110	2	1

I feel that the data from the balsam fir do not reveal the true situation. Small mammal sign in the area was abundant. The poor showing by trapping may have been due in part to the robbing of traps by predators. A number of traps were carried some distance from the original site and one of these contained the remains of a wood mouse.

General observations among 60 plantations indicated that small mammals were more abundant in plantations with good moss and herbaceous ground cover than in those with only a heavy needle litter. This probably reflected increased cover rather than better food conditions. The results of this small study parallel those obtained by Morris (Jour. Mamm., 36: 21–35, 1955) in eastern Canada and point out the importance of ground cover to the small mammals of the forest.—ROBERT LEO SMITH, *Division of Forestry, West Virginia Univ., Morgantown.* *Received December 20, 1957.*

REVIEWS

Young, Stanley P. THE BOBCAT OF NORTH AMERICA. The Stackpole Company, Harrisburg, Pa. and The Wildlife Management Institute, Washington, D.C. xiv + 193 pp., 40 illus. October 30, 1958. Price, $7.50.

The bobcat is seldom seen alive and free, yet is credited with legendary powers of cunning and ferocity. In this the last of a series of four monographs on North American predators, Stanley Young brings many years of field experience and first-hand knowledge to bear on the real nature of this handsome predator.

It would be difficult, if not impossible, to find a scientist better qualified on the subject of North American predators and their habits. For more than forty years, as a scientist with the former U.S. Biological Survey and later with the U.S. Fish and Wildlife Service, Mr. Young has devoted a lively career to the study of these species. In this book he has drawn from a rich supply of personal observations, from the published literature, from personal interviews with hunters, trappers, stockmen and sportsmen, and from data in the files of the former Biological Survey and of the Fish and Wildlife Service. The book is arranged into an introductory chapter, chapters on distribution, habits and characteristics, parasites and diseases, economic status, hunting and control, and races of the bobcat. A short conclusion is followed by a reference list and selected bibliography of 780 titles.

The range of the bobcat includes most of North America between the 18th and 50th parallels; from the Atlantic to Pacific oceans and from the mountains of southern Alberta and British Columbia south to Rio Mescale, Mexico. Within this range the abundance and habitat distributions of bobcats are locally modified by terrain and vegetation, and often by land use. Western bobcats prefer canyon habitats, especially those in which the vegetation includes such species as pinyon, juniper, and mountain-mahogany. Bobcats in the Southeast, on the other hand, frequent magnolia forest, canebrakes and swamp habitat. Agriculture and timber cutting have, in many cases, created habitats favorable to bobcats. With this ability to adapt to a variety of conditions, bobcats are becoming more abundant throughout most of their range. State and federal hunters killed 1,499 bobcats in Wyoming in 1954, for example—the greatest number recorded in that state in 39 years of predator control.

Much has been written and a good deal more said about the maximum size and weight of mature bobcats. The author cites the case of a "47 pound monster," killed in Pennsylvania, that weighed 23 pounds when it reached an accurate scale. The average weight of a mature bobcat is between 18 and 25 pounds, although a table of weights of the largest bobcats known to the author includes males in the 40- and 50-pound class and one adult male killed in 1951 near Walsenburg, Colorado, that weighed 69 pounds.

In 1718 the colonial historian John Lawson, commenting on the predatory nature of bobcats, wrote: "Thus he takes Deer (which he cannot catch by running) and fastens his Teeth into their Shoulders and sucks them. They run with him, till they fall down for want of strength, and become Prey to the Enemy." Lawson's description was remarkably accurate. Bobcats can and do prey on deer, sometimes quite regularly, and in the manner John Lawson described. Many authenticated accounts from areas throughout its range establish the fact that bobcats readily turn to larger prey when rabbits, their usual prey, are scarce. Moreover, these accounts are not restricted to cases of large bobcats preying only on fawns or weak deer—the bobcat is a small but highly aggressive and powerful predator that has earned its reputation fairly.

In discussing the economic status of the bobcat, Mr. Young records his opposition to the unnecessary destruction of any animal. His studies, which have culminated in monographs on the puma, wolf, coyote and bobcat, have been motivated by the fascination and scientific interest these species hold. But his inquiry has also been based upon "a recognition of man as a member of nature's community" and "his primary right in the struggle for existence"

(p. 62). Bobcats as well as other large predators are unquestionably responsible for serious losses to livestock and poultry. Since bobcats seldom return to a kill after they have fed, the slaughter of as many as 38 lambs by one bobcat in a single night can only be classed as useless and indiscriminate. This sort of loss is hard for a rancher to absorb and impossible to sustain for long. Yet, in spite of these facts, this reviewer felt that the author could have taken a more emphatic stand on the question of predator control. Predator control is a controversial, misunderstood and much-debated subject. The Fish and Wildlife Service is responsible by law for investigation and control of predators, but many feel that they have not explained their position satisfactorily and have not provided sufficient justification for general control as it is practiced. No one is better equipped than Mr. Young to discuss this problem and no agency has more data available on the subject than the Fish and Wildlife Service. Does the economic loss from predators justify the cost of control? How great an economic loss is averted by present operations? Would local rather than general control measures achieve satisfactory results? The answers to these and other questions on this subject would be of interest to many scientists and naturalists, as well as state and federal agencies immediately concerned with the problem. A detailed examination of this problem is perhaps outside the scope of these monographs, but it is hoped that it will be dealt with soon by someone with Mr. Young's qualifications.

This book is by no means an exhaustive treatise, but it does contain an interesting selection of facts and lore about bobcats. The style is informal, relying to a considerable extent on personal observation and experience and quotations from experienced observers. The result is a readable and well illustrated book which is commended to both amateur and professional naturalists.—Richard S. Miller.

Crisler, Lois. Arctic Wild. Harper & Brothers, New York. xv + 301 pp., 32 pages of photographs. Foreword by A. Starker Leopold. October, 1958. Price, $4.95.

The name Crisler is no stranger to readers of the *Journal of Mammalogy* nor to anyone who is interested in the study of animals. Lois Crisler's paper on wolf-caribou relations (vol. 37: 337–346) is well known and Herb Crisler's film, "The Olympic Elk," is a classic. This book is the intensely personal and vivid account of the eighteen months that the Crislers spent in northern Alaska. Their reason for going there was wildlife photography. The photographic success of their venture is evident to all who have seen the film, "White Wilderness," to which Herb Crisler's footage contributed so much.

With the appearance of this book it is clear that the motion picture footage was only another result of their wilderness stay. Lois and Herb Crisler are revealed as extremely observant students of animal behavior whose observations delve beneath the visible actions of unfettered yet fraternal animals to probe the ecological and evolutionary implications of the actions.

The Crislers were the guests of several mammals—wolves, caribou, wolverines—while in the Brooks Range. Because these naturalists are of that rare breed, truly civilized humans, they so conducted themselves that they were accepted into the social life of the wolves they raised. Being accepted into the complex social life of a highly organized and sensitive wild mammal is a privilege which has been extended to few humans. The Crislers have thus entered the company of Grizzly Adams, Ernest Thompson Seton and Konrad Lorenz.

In addition to being a major source of information on behavior and social life of wolves, this book presents observations, in more rounded detail than does her paper in this *Journal*, on the hunting tactics of wolves. These observations confirm those made by other competent naturalists that the caribou which is killed by wolves is almost certain to be lame, diseased or parasitized. The Crislers have reached a high point in perfection of caribou observing when they can tell, within the first few seconds of a chase, if an unfit animal is in the band being pursued. Because of the evolutionary importance of this culling action, the wolf, instead of being doomed with a price on his head and agonizing poisons served to him,

should be, in a land governed by civilized and rational humans, recognized as the master herder and rigidly protected.

Besides being a notable contribution to the study of animal behavior and a strong argument for a drastic overhaul in the concepts and practices of wildlife management in Alaska, this book is a sheer joy to read. Mrs. Crisler possesses an unusual facility with words and some of her descriptions are rare gems: a wolf's "eel-supple spine," "the last frail wonderful webs of wilderness now vanishing from Earth," her comparison of the massed migration of caribou to spring break-up on the Yukon, a wolf's tail "rippling and spiraling."

Her description of life over break-up in a tent on the tundra vividly recalls for me the humming and keening of wind in the guy ropes, the crash and surge of the tent trying to achieve escape velocity and the futility of trying to keep snow from sifting through tiny openings in a straining canvas wall.

"After a minute or two the caribou turned and started on, using the beautiful upward launch which caribou employ when no camera is running." How true! I recall how my wife and I tried for days to photograph the flight jump of caribou in arctic Canada and the statistically improbable but undeniably true propensity which caribou have of never exhibiting the flight jump when the camera is running.

How I can sympathize with Herb when he stalked to within fifty feet of a wolverine excavating voles, and had no camera with him. I recall the day I left camp for just a short time, without a camera, and that was the day a wolf mistook me for a caribou and photogenically stalked me. All in bright sunlight.

It should be obvious by this time that I wholeheartedly recommend this book, especially to students of wildlife management, for they are the ones who one day will assume responsibility for this, the most fragile of all ecological communities—for tundra, wolves, caribou, voles and mountains. One can only fervently hope that the professional wolf haters, the wildlife poisoners and the seething commercial interests in Alaska are confounded and overwhelmed by sane, rational men and that some of the Arctic Wild will remain to inspire future generations. A book such as this is of more value to the human race than are all the gold mines in Alaska. ARCTIC WILD is fittingly dedicated: "To the wolves of the Arctic tundra and to those people who will act to preserve life and habitat for them."—WILLIAM O. PRUITT, JR.

Hill, W. C. Osman. PRIMATES. COMPARATIVE ANATOMY AND TAXONOMY. Volume III: *Pithecoidea: Platyrrhini (Families Hapalidae and Callimiconidae).* Interscience Publishers, Inc., New York and University Press, Edinburgh. Pp. xix + 354, 102 figs., 27 plates, 1957. Price, $13.50.

As indicated by the subtitle, this latest volume of a series of monographs on primates introduces the suborder, here called Pithecoidea; surveys in a generalized fashion the entire New World group of platyrrhines; and then deals in detail with the "families Hapalidae and Callimiconidae." The first two volumes had been devoted in a corresponding manner to what are commonly called the prosimians. With this third monograph the erudite author begins his systematic description of all living and extinct simian primates, to which four more future volumes are to be devoted.

The first third of this book gives a condensed survey of the common features and main specializations characterizing the suborder Pithecoidea, and afterwards those typical of the infraorder Platyrrhini. Here one finds a systematic enumeration of the most significant conditions appertaining to external features, skeletal system, dentition, myology, splanchnology, angeiology, neurology, sense organs, development, behavior, parasites, distribution and taxonomy (including many interesting historical notes). That some of these chapters differ greatly in length and detail is largely due to the extremely uneven state of our present relevant knowledge. As a summary of only one author's devoted efforts to collect, augment and evaluate all these data, this section of the book represents an admirable undertaking of greatest help to all students of primates for reference and stimulation. In contrast to some other

recent views, Hill fortunately endorses Buffon's old distinction between Platyrrhini and Catarrhini as being of the rank of infraorders, stating that "there is much more community of structure between Cercopithecoidea and Hominoidea than there is between either and the New World forms."

Mammalogists and taxonomists will welcome particularly the large part of this book in which Hill describes, in systematic detail and with full consideration of all anatomical findings, that group of primates which needed a revision more than any other group— the marmosets, of which ten genera and numerous species are recognized here. These are not only classified according to their most significant distinctions, but there are also very instructive discussions of their nomenclature, distribution, reproduction and behavior. The rare and interesting Goeldi's monkey, *Callimico*, is described in the text as the sole representative of a separate family, midway between the Hapalidae and Cebidae, largely because it has retained third molars. In the preface, however, Hill could insert the important announcement, based on his fortunate, last-minute chance for dissecting a specimen himself, that "*Callimico* is a tamarin" and deserves at most subfamily rank. From what the reviewer has recently seen of dead and living *Callimico* he can fully support this conclusion.

The only criticisms of this work are found (1) in the considerable repetition resulting from the arrangement of the text according to the zoological system and with summaries of large and then again of progressively smaller groups; and (2) in the choice of some of the names for major groups. For instance, regarding his preference for the term Hapalidae, Hill himself admits that it "according to the rules should be replaced by *Callithricidae*."

As the preceding volumes, this one is generously and excellently illustrated with drawings of anatomical structures, maps of distribution and photographs mostly of living specimens. There is also a very useful bibliography of the vast amount of literature consulted by the author. The printing is perfect and the price very reasonable. Altogether, this great work can be most highly recommended as an outstanding contribution to mammalogy and to comparative anatomy.—ADOLPH H. SCHULTZ.

Hershkovitz, Philip. A GEOGRAPHIC CLASSIFICATION OF NEOTROPICAL MAMMALS. Fieldiana: Zoology, Vol. 36, No. 6, pp. 583–620. July 11, 1958.

This is an interesting reexamination of the zoogeographical status of tropical America with special reference to Central America and the West Indies, particularly significant in connection with recent papers by Schmidt and Simpson and with Darlington's ZOOGEOGRAPHY. After a brief historical review, a number of useful zoogeographical definitions are given. Several important points are made, the most significant being, in my opinion, the following: *First*, the emphasis that faunal comparisons between regions be made on the same time level; *Second*, the insistence that a comparison of land mammal faunas should include bats; *Third*, the contrast between excurrent regionalites (forms which are predominately of one zoogeographical region, but which overlap into another) and varicants (forms which overlap two adjacent regions so broadly that no decision can be made regarding which they should be associated with).

A strong case is made for the inclusion of both Central America (with southern Mexico) and the West Indies in the Neotropical Region, and indeed the former is considered as part of the Brazilian Subregion of South America on the basis of its very small number of endemics and the paucity of Nearctic genera which extend into it but do not reach South America. The northern boundary of the Neotropical Region is shown to include eastern Mexico as far north as southern Tamaulipas, but all of western Mexico above Oaxaca is considered Nearctic or transitional. I would be inclined to extend the Neotropical Region up along the west coast at least as far as Jalisco and possibly to southern Sonora. I have not made an analysis of the mammals of this area, however.

A valuable part of the paper is the series of distributional tables, particularly Table XIII which shows the regional distribution of every land or freshwater genus in the Americas. It is, of course, on these tables that the zoogeographical conclusions are based. Unfortunately,

the tables are marred by a number of errors. These are, at least in part, typographical since in some copies missing items have been added in ink. The following are corrections of what appear to be the most serious errors. *Sorex* (like *Microtus*), at least as I understand it, is a Nearctic-Palearctic variant excurrent into southern Mexico and Central America. *Microsorex* does not reach northern Mexico. *Desmodus* reaches northern Mexico. *Amorphochilus* reaches Chile, and therefore the Patagonian Subregion. *Idionycteris* reaches the United States. *Sciurus* does not occur in the West Indies, at least as I would delimit them. *Pitymys* occurs in northern Mexico. *Taxidea* is an endemic Nearctic regionalite and not a Nearctic-Palearctic varicant. *Ursus* and *Ovis*, on the other hand, as I understand them, are Nearctic-Palearctic varicants and not cosmopolites. These criticisms, however, do not affect the fact that this is an important contribution to the zoogeography of the mammals of the Western Hemisphere.—KARL F. KOOPMAN.

Verschuren, Jacques. ÉCOLOGIE, BIOLOGIE ET SYSTÉMATIQUE DES CHEIROPTÈRES. Inst. Parcs Nationaux Congo Belge. Exploration Parc Natl. Garamba. Mission H. de Saeger. Pt. 7, pp. 1–473, 178 figs., color pl., map. March 15, 1957. [In French].

Scientific research is one of the primary objectives of the Institute of the National Parks of the Belgian Congo. To this end the Institute has sponsored much exploration and has published, since 1937, more than 200 technical papers on the biology, geology, climatology, and anthropology of the Congo parks. Biological investigations have aimed not only for a systematic inventory and collection of specimens, but for a thorough synthesis of ecological and biological phenomena as well.

Verschuren's monograph is the result of a two-year study of the bats of the Garamba National Park in extreme northeastern Belgian Congo. His material (1,245 specimens, representing 38 species) surpasses all other African bat collections from areas of similar extent (about 60 by 25 miles). Four species had not been taken previously in the Congo, and one form, *Hipposideros beatus maximus*, is described as new. Based on these collections, seven nominal species and subspecies are placed in synonymy.

Initial chapters consider in general terms the subjects of bat ecology, sex ratios, population dynamics, sociability, food habits, reproduction, habits, contact with man, classification and study techniques. Subsequent chapters provide detailed data and discussion on each species. Subheadings in each account are: specimens collected, geographic distribution, external and cranial measurements, systematics, coloration, genitalia, external morphology, age variation, ecology, sociability, sex ratios, food habits, reproduction, other natural history and methods of capture. The volume is exceptionally well illustrated.

The great quantity of detailed data and its thoughtful analysis and discussion make this monograph desirable for the libraries of students of Chiroptera, regardless of their regional interests. In addition, the unusual presentation of information on roost preferences commends the volume to field men everywhere.—CHARLES O. HANDLEY, JR.

Cruickshank, Helen Gere, *Ed.* JOHN AND WILLIAM BARTRAM'S AMERICA. [American Naturalists Series.] New York: Devin-Adair Co. Pp. xxii + 418, illus. by Francis Lee Jacques. July 24, 1957. Price, $5.00.

Harper, Francis, *Ed.* THE TRAVELS OF WILLIAM BARTRAM. [Naturalist's Edition.] New Haven: Yale University Press. Pp. lxi + 727, illus. largely by William Bartram. May 7, 1958. Price, $8.50.

The Bartrams, father and son, were kindred spirits of Gilbert White and the later Henry Thoreau, John Burroughs, John Muir and Enos Mills. They were the sort of early American who loved their country for its own sake, and they have left us an unrivalled picture of the remote regions in the late eighteenth century. John (1699–1777), a self-educated Quaker

farming on the Schuylkill River, had a passionate interest in plants which led him to establish, at Philadelphia, the first American botanical garden; he was one of the nine original members of the American Philosophical Society. In 1765 he was appointed Botanist to His Majesty George III—but his loyalty to the Colonies seems to have persisted in the years ahead, although his religion prevented him taking any active part or even expressing his views in his writings. His interest in birds was only slightly less than that in botany; especially noteworthy are his accounts of Florida water birds. His travels took him, in 1743, from Philadelphia to Oswego on Lake Ontario; in 1765, to St. Augustine and up the St. John's River; and to the Catskills and elsewhere at a period when such exploration was fraught with danger and hardship.

Of John's seven sons, William (1739–1823) was most inclined to natural history. His early attempts at agriculture and business remind one of Audubon's experiences; but he later turned to traveling and collecting, exhibited a flourish for writing, and developed a talent for illustrating. His well-known *Travels*, published in 1791, recount his experiences on a trip through the Carolinas, Georgia, Florida and other country in 1773–1778. This volume was drawn upon by both Wordsworth and Coleridge for some of their own works. It is rich in descriptions of plants and animals, of frontier trading posts and Indian customs, and of the unspoiled wilderness. Specimens were collected and sketches made (some of each still extant) and many of these found their way to European workers through the offices of his patrons, the London merchant Peter Collinson, an enthusiastic amateur of "natural curiosities," and John Fothergill.

In these pages we read bits of correspondence with Mark Catesby, Joh. Fred. Gronovius, George Edwards and Carolus Linnaeus. We enjoy glimpses of such personages as Alexander Wilson and Thomas Nuttall, Benjamin Franklin and Thomas Jefferson, John Le Conte, George Ord, André Michaux, Peter Kalm and Henry Muhlenberg, James Madison and Alexander Hamilton. And we gain an intimate insight into the beginnings of methodical natural history in this country.

John records, in Florida, the earliest known description of the wood rat: "We found a great nest of a wood rat, near four feet high and five in diameter, built of long pieces of dry sticks, all laid confusedly together. On stirring the sticks to observe their structure, a large rat ran out, and up a very high sapling with a young one hanging to its tail."

From central Georgia, William writes of the "animal productions" as "the same which originally inhabited this part of North America, except such as have been affrighted away since the invasion of the Europeans. The buffalo (Urus) once so very numerous, is not at this day to be seen in this part of the country; a few elk, and those only in the Apalachian mountains. The dreaded and formidable rattle-snake is yet too common. . . . The allegator, a species of crocodile, abounds in the rivers and swamps, near the sea coast, but is not to be seen above Augusta. Bears, tygers,* wolves, and wild cats (Felis cauda truncata) are numerous enough; and there is a very great variety of Papilio and Phalina, . . . as well as other insects of infinite variety."

These two volumes are a notable addition to the considerable Bartramian literature. Each is carefully edited, well printed and attractively gotten out. The Harper book, concerned with William's travels, is an altogether scholarly work, thoroughly annotated and indexed and containing an enlightening Introduction. It interprets the *Travels*, for the first time, with particular emphasis on the naturalist's point of view. Cruickshank's book, dealing with both father and son, contains an adequate Index and Glossary and a good Introduction, as well as the especially apt selections from the Bartrams' letters, diaries and publications, many of them previously unpublished. Both volumes are enhanced by significant maps and other illustrations, and make admirable reading for serious study or leisurely browsing.—RICHARD H. MANVILLE.

* "This creature is called, in Pennsylvania and the northern States, Panther; but in Carolina and the southern States, is called Tyger; they are very strong, much larger than any dog, of a yellowish brown, or clay colour, having a very long tail; they are a mischievous animal, and prey on calves, young colts, &c."

RECENT LITERATURE

(Prepared by the Committee on Bibliography)

[Reprints of this bibliographic section may be purchased from the Secretary-Treasurer. However, the Society cannot furnish reprints of the individual publications listed.]

AKHTAR, S. A. The rodents of West Pakistan. Part I. Pakistan Jour. Sci., 10 (1): 5–18. January, 1958. (Squirrels.)

ANDERSEN, SVEND, AND HOLGER POULSEN. Two musk-oxen (*Ovibos moschatus* Zimm.) in captivity. Zool. Garten, 24 (1–2): 12–23, illus. 1958.

ANONYMOUS. Present status of the *Microtus* outbreak in California. California Vector Views, State Dept. Publ. Health, 5 (7): 47. July, 1958.

APPELMAN, F. J. Zur Ernährung des Grossen Ameisenbären, *Myrmecophaga tridactyla*. Zool. Garten, 24 (1–2): 102–193, illus. 1958.

BAUDENON, P. Note sur le statut des ongulés au Togo. Mammalia, Paris, 22 (3): 390–393. September, 1958.

BECK, W. H. A guide to Saskatchewan mammals. Special Publ. Saskatchewan Nat. Hist. Soc., Regina, no. 1, pp. 1–52, illus. 1958.

BELL, F. R. The mechanism of regurgitation during the process of rumination in the goat. Jour. Physiol., Cambridge, England, 142 (3): 503–515. August, 1958.

BERE, R. M. The status of ungulate mammals in the Uganda national parks. Mammalia, Paris, 22 (3): 418–426. September, 1958.

BERGER, GOTTHART. Befall eines Potto (*Perodicticus potto* Geoffr.) durch Pentastomiden. Zool. Garten, 24 (1–2): 10–12, illus. 1958.

BIGALKE, R. C. On the present status of ungulate mammals in South West Africa. Mammalia, Paris, 22 (3): 478–497. September, 1958.

BIRCH, L. C. The role of weather in determining the distribution and abundance of animals. Cold Spring Harbor Symposia on Quantitative Biology, 22: 203–218. 1957.

BLANCOU, L. Note sur le statut actuel des ongulés en Afrique équatoriale française. Mammalia, Paris, 22 (3): 399–405. September, 1958.

BOURGOIN, P. Les ongulés dans les territories de l'Union française. Mammalia, Paris, 22 (3): 371–381. September, 1958.

BOYD, J. MORTON. Mole and stoat on Eilean Molach, Loch Ba, Argyll. Proc. Zool. Soc. London, 131 (2): 327–328. September 19, 1958.

BRACHER, FRITZ. Der Cyclus des Goldhamster-Epoophorons. Zeitschr. Anat. & Entwicklungsgesch., 120: 201–210. 1957.

BROADBOOKS, HAROLD E. Life history and ecology of the chipmunk, *Eutamias amoenus*, in eastern Washington. Misc. Publ. Mus. Zool. Univ. Michigan, 103: 1–42, illus. July 31, 1958.

BRUNE, H. Rohstoffe der Haussäugetiere. Handbuch der Zoologie, Berlin, Band 8, Teil 12, Beitrag 4 (Lieferung 17), pp. 1–48. July, 1958.

BUCHANAN, G. D. The current range of the armadillo *Dasypus novemcinctus mexicanus* in the United States. Texas Jour. Sci., 10 (3): 349–351. September, 1958.

BULL, P. C. Incidence of coccidia (Sporozoa) in wild rabbits, *Oryctolagus cuniculus* (L.), in Hawke's Bay, New Zealand. New Zealand Jour. Sci., 1 (2): 289–329. June, 1958.

CAIN, A. J., AND G. A. HARRISON. An analysis of the taxonomist's judgment of affinity. Proc. Zool. Soc. London, 131 (1): 85–98. July 24, 1958.

CARPENTER, C. R. Soziologie und Verhalten freilebender nichtmenschlicher Primaten. Handbuch der Zoologie, Berlin, Band 8, Teil 10, Beitrag 11 (Lieferung 18), pp. 1–32. August, 1958.

CARRICK, R. What is the best free-feeding system for furrow-poisoning the rabbit? C.S.I.R.O. Wildlife Research, Canberra, Australia, 2 (2): 78–84. 1957.

CHATFIELD, PAUL O. Physiologie der peripheren Nerven. Handbuch der Zoologie, Berlin, Band 8, Teil 7, Beitrag 6 (Lieferung 17), pp. 1–32. July, 1958.

CHOW, MINCHEN M., AND HSU YU-HSIUAN. A new species of fossil Bubalus from Menghsien, Honan. Acta Palaeontol. Sinica, 5 (3): 457–466, illus. August, 1957. (New: *Bubalus youngi.*)

CHOW, MINCHEN, AND HSIEH HSIANG-HSU. Some Pleistocene mammalian fossils from Chienping and Kongping, Liaoning. Acta Palaeontol. Sinica, 6 (1): 51–58, illus. February, 1958.

COPPENS, YVES. Le mammouth de l'Atrikanova (Sibérie). Bull. Mus. Nat. Hist. Nat., Paris, ser. 2, 30: (4): 402–406. September 20, 1958.

COWIE, MERVYN. On the present status of ungulate mammals in Kenya. Mammalia, Paris, 22 (3): 427–434. September, 1958.

CRANDALL, LEE S. Notizen über das Verhalten des Schnabeltieres (Ornithorhynchus anatinus) in Gefangenschaft. Handbuch der Zoologie, Berlin, Band 8, Teil 10, Beitrag 8 (Lieferung 18), pp. 1–8. August, 1958.

CREISLER, JOE. The disposal of dead marine mammals. California Vector Views, State Dept. Public Health, 5 (10): 65–67, illus. October, 1958.

CRUSAFONT-PAIRO, M. Endemism and Paneuropeism in Spanish fossil mammalian faunas, with special regard to the Miocene. Comment. Biol., Helsingfors, 18 (1): 1–31, illus. 1958.

CRUSAFONT-PAIRO, M., AND J. TRUYOLS-SANTONJA. A quantitative study of stasigenesis in fissipede carnivores. Nature, 181: 289–290. January 25, 1958.

CURRY-LINDAHL, KAI. Brown bears (*Ursus arctos*) and foxes (*Vulpes vulpes*) living together in the same enclosure. Zool. Garten, 24 (1–2): 1–8, illus. 1958.

CURRY-LINDAHL, KAI. Zoogeography, population dynamics and recent faunal changes. Ymer. Stockholm, 1958 (1): 5–57. 1958. (In Swedish, with English summary.)

CURRY-LINDAHL, KAI. The vertebrate fauna of the Sarek mountains and the Padjelanta plain in Swedish Lapland. Fauna och Flora, 53 (1–2): 39–71; (3–4): 97–149, map. 1958. (In Swedish, with English summary.)

DAL', S. K. Sistematicheskii obzor zhivotnykh Kryma. I. Mlekopitayushchie—Mammalia. Zhivotnyi Mir SSSR, Zool. Inst. Akad. Nauk SSSR, vol. 5 (Gornye oblasti Europeiskoi Chasti SSSR), pp. 42–55. 1958.

DAVIS, D. H. S., AND A. G. OETTLÉ. The multimammate mouse *Rattus* (*Mastomys*) *natalensis* Smith: a laboratory-adapted African wild rodent. Proc. Zool. Soc. London, 131 (2): 293–299, pl. 1. September 19, 1958.

DAVIS, JOSEPH A., JR. A new shrew (*Sorex*) from Florida. Amer. Mus. Novitates, 1844: 1–9. October 10, 1957. (New: *S. longirostris eionis.*)

DEKEYSER, P. L. L'avenir des ongulés en A.O.F. Mammalia, Paris, 22 (3): 382–386. September, 1958. (French West Africa.)

DELANY, M. J. The small mammals of a Dumbartonshire oakwood. Glasgow Naturalist, 17 (6): 272–278. October, 1957.

DONISTHORPE, J. H. A pilot study of the mountain gorilla (*Gorilla gorilla beringei*) in south west Uganda, February to September, 1947. South African Jour. Sci., 54 (8): 195–217. August, 1958.

DORST, JEAN. Enquête sur le statut actuel des ongulés dans l'Afrique au Sud du Sahara. Introduction. Mammalia, Paris, 22 (3): 357–370. September, 1958.

DRAKE, JAMES J. The brush mouse *Peromyscus boylii* in southern Durango. Publ. Mus. Michigan State Univ., Biol. Ser., 1 (3): 97–132, illus. July 24, 1958.

DUNNET, G. M. Notes on emergence behaviour of the rabbit, *Oryctolagus cuniculus* (L.), and its bearing on the validity of sight counts for population estimates. C.S.I.R.O. Wildlife Research, Canberra, Australia, 2 (2): 85–89. 1957.

DUNNET, G. M. A test of the recapture method of estimating the number of rabbits, *Oryctolagus cuniculus* (L.), in a warren. C.S.I.R.O. Wildlife Research, Canberra,

Australia, 2 (2): 90–100. 1957.

EBLE, HEINRICH. Sarcocystis muris bei einer Microtus. Säugetierk. Mitteil., 6 (3): 100–103, illus. July 1, 1958.

EDWARDS, R. Y., AND R. W. RITCEY. Reproduction in a moose population. Jour. Wildlife Management, 22 (3): 261–268. July, 1958.

EGOSCUE, HAROLD J., AND BILLY N. DAY. Orange-tan—a recessive mutant in deer mice. Jour. Heredity, 49 (4): 189–192. July–August, 1958.

EISENTRAUT, M. Beitrag zur Chiropteren-Fauna von Kamerun (Westafrika). Zool. Jahrb., Jena, 84 (6): 505–540. December 27, 1956. (New: *Hipposideros camerunensis.*)

EISENTRAUT, MARTIN, H. KNIPPER, AND G. ZINK. Beitrag zur Chiropterenfauna Ostafrikas. Veröffentl. Überseemus. Bremen, Reihe A, 3 (1): 17–24. March 30, 1958.

ELLIOT, G. H. Politics and the Antarctic whale. Sea Frontiers, Internat. Oceanogr. Foundation, Coral Gables, 4 (3): 171–181, illus. August, 1958.

EMMONS, CHESTER W. Association of bats wtih histoplasmosis. Publ. Health Repts., U.S. Publ. Health Service, 73 (7): 590–595. July, 1958.

ENDERS, A. C., G. D. BUCHANAN, AND R. V. TALMAGE. Histological and histochemical observations on the armadillo uterus during the delayed and post-implantation periods. Anat. Record, Philadelphia, 130 (4): 639–658. April, 1958.

EWER, R. F. Adaptive features in the skulls of African Suidae. Proc. Zool. Soc. London, 131 (1): 135–155, pls. 1–3. July 24, 1958.

FENNER, FRANK, W. E. POOLE, I. D. MARSHALL, AND A. L. DYCE. Studies in the epidemiology of infectious myxomatosis of rabbits. VI. The experimental introduction of the European strain of myxoma virus into Australian wild rabbit populations. Jour. Hygiene, 55 (2): 192–206, pl. 4. June, 1957.

FETISOV, A. S. Data on the ecology of *Microtus oeconomus* Pall. in Eastern Siberia. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (2): 55–60. 1958. (In Russian, with English summary).

FIELDS, ROBERT W. (Editor.) Guidebook, Eighth Field Conference, Society of Vertebrate Paleontology, Western Montana. Montana State Univ. Publ., pp. 1–50, illus. August, 1958. (Lists Cenozoic mammalian faunas from western Montana.)

FISHER, K. C., AND MARY E. NEEDLER. Spontaneous activity of the lemming *Dicrostonyx groenlandicus richardsoni* Merriam as indicated in 24-hour records of oxygen consumption. Jour. Cellular & Comp. Physiol., Philadelphia, 50 (2): 293–308. October, 1957.

FLEAY, DAVID. Platypuses in the zoo again. Animal Kingdom, New York Zool. Soc., 61 (4): 98–108, illus. August, 1958.

FLYGER, V. F., AND J. R. BOWERS. The sika deer of James Island, Maryland. Maryland Tidewater News, 14 (4): 13–14. August, 1958.

FLYGER, V. F., AND JOHN WARREN. Sika deer in Maryland—an additional big game animal or a possible pest. Maryland Dept. Research & Education, Annapolis, pp. 1–4 (mimeogr.). 1958.

FRADE, F. Mesures adoptées pour la protection de l'hippotrague géant en Angola. Mammalia, Paris, 22 (3): 476–477. September, 1958.

FRASER, A. D. On the present status of ungulates in Southern Rhodesia. Mammalia, Paris, 22 (3): 469–475. September, 1958.

FRIANT, MADELINE. Un stade de l'évolution cérébrale du rorqual (*Balaenoptera musculus* L.). Hvalridets Skrifter, Norske Videnskaps-Akademi, Oslo, 42: 1–15. 1958.

FROMMHOLD, E. Rotlaufbakterien in Milz und Leber eines Rehbockes. Zool. Garten, 24 (1–2): 103. 1958.

GAZIN, C. LEWIS. A review of the Middle and Upper Eocene primates of North America. Smithsonian Misc. Coll., Washington, 136 (1): 1–112, pls. 1–14. July 7, 1958. (New: *Anemorhysis, Chlororhysis, C. knightensis, Uintalacus, U. nettingi,* family *Omomyidae, Omomys lloydi, Utahia, U. kayi, Stockia, S. powayensis, Ourayia,*

Anaptomorphus wortmani, Apatemys downsi.)

George, R. S. Notes concerning five species of mammals in the West country. Proc. Zool. Soc. London, 131 (2): 323–325. September 19, 1958.

Gersdorf, E. Fressen Feldhasen (*Lepus europaeus*) Feldmäuse (*Microtus arvalis*)? Säugetierk. Mitteil., 6 (3): 103–105. July 1, 1958.

Gersdorf, E. Zur Nahrungsaufnahme der Zwergmaus, *Micromys minutus* (Pallas). Säugetierk. Mitteil., 6 (3): 105–107. July 1, 1958.

Gilbert, O., and R. Stebbings. Winter roosts of bats in West Suffolk. Proc. Zool. Soc. London, 131 (2): 329–333. September 19, 1958.

Gleeson, J. P., and F. S. Maguire. A toxicity study of rabbit fumigants. C.S.I.R.O. Wildlife Research, Canberra, Australia, 2 (2): 71–77. 1957.

Gopalakrishna, A. Foetal membranes in some Indian microchiroptera. Jour. Morphol., Philadelphia, 102 (1): 157–197. January, 1958.

Griffin, Donald R. More about bat "radar." Scientific American, 199 (1): 40–44, illus. July, 1958.

Griffin, D. R., and A. D. Grinnell. Ability of bats to discriminate echoes from louder noise. Science, 128 (3316): 145–147. July 18, 1958.

Griffin, D. R., A. Novick, and M. Kornfield. The sensitivity of echolocation in the fruit bat, Rousettus. Biological Bulletin, 115 (1): 107–113. August, 1958.

Grimwood, I. R., C. W. Benson, and W. F. H. Ansell. The present-day status of ungulates in Northern Rhodesia. Mammalia, Paris, 22 (3): 451–468, map. September, 1958.

Grinnell, Alan D., and Donald R. Griffin. The sensitivity of echolocation in bats. Biological Bulletin, 114, (1): 10–22. February, 1958.

Grüneberg, H. Genes in mammalian development. Inaugural Lecture, University College, London, pp. 1–17. 1957.

Grzimek, Bernhard. Die gegenwärtige Zahl der Nashörner auf der Erde. Säugetierk. Mitteil., 6 (3): 117–120, illus. July 1, 1958.

Guiler, Eric R. The thylacine. Australian Mus. Mag., Sydney, 12 (11): 352–354. September 15, 1958.

Gupta, A. C. Tigers at high altitudes. Jour. Bengal Nat. Hist. Soc., 29 (1–2): 55–56. April–August, 1957.

Haas, Gerhard. 24-Stunden-Periodik von Grosskatzen im Zoologischen Garten. Säugetierk. Mitteil., 6 (3): 113–117. July 1, 1958.

Hagmeier, Edwin M. Inapplicability of the subspecies concept to North American marten. Systematic Zoology, 7 (1): 1–7. March, 1958.

Haines, R. W. Arboreal or terrestrial ancestry of placental mammals. Quarterly Rev. Biol., 33 (1): 1–23. March, 1958.

Haltenorth, Th. Besteht die Borkum-Unterart des Wildkaninchens (*Oryctolagus cuniculus borkumensis* Harrison, 1952) zu Recht? Säugetierk. Mitteil., 6 (3): 123–124, illus. July 1, 1958.

Hamilton, W. J., Jr. Early sexual maturity in the female short-tailed weasel. Science, 127 (3305): 1057. May, 1958.

Haugen, Arnold O., and Daniel W. Speake. Determining age of young fawn white-tailed deer. Jour. Wildlife Management, 22 (3): 319–321. July, 1958.

Hayman, R. W. A new genus and species of West African mongoose. Ann. & Mag. Nat. Hist., ser. 13, 1: 448–452. July, 1958. (New: *Liberiictis, L. kuhni.*)

Hediger, H. Verhalten der Beuteltiere Marsupialia. Handbuch der Zoologie, Berlin, Band 8, Teil 10, Beitrag 9 (Lieferung 18), pp. 1–28. August, 1958.

Heim de Balsac, H. La Réserve naturelle intégrale du Mont Nimba, part XIV. Mammifères insectivores. Mem. Inst. Français Afrique Noire, 53 (4): 301–337. September, 1958. (New: *Crocidura* (*bottegi*) *eburnea, C.* (*b.*) *obscurior, C. douceti, C. jouvenetae.*)

HEIM DE BALSAC, H., AND M. LAMOTTE. La Réserve naturelle intégrale du Mont Nimba, part XV. Mammifères rongeurs. Mem. Inst. Français Afrique Noire, 53 (4): 339–357. September, 1958.

HERSHKOVITZ, PHILIP. A geographic classification of Neotropical mammals. Fieldiana, Zool., Chicago Nat. Hist. Mus., 36 (6): 579–620. July 11, 1958.

HEWSON, RAYMOND. Moults and winter whitening in the mountain hare *Lepus timidus scoticus*, Hilzheimer. Proc. Zool. Soc. London, 131 (1): 99–108. July 24, 1958.

HILL, W. C. OSMAN. The correct scientific name of the weeper capuchin. Proc. Zool. Soc. London, 131 (2): 316–318. September 19, 1958.

HOFFMEISTER, DONALD F., AND JOHN R. WINKELMANN. The os clitoridis in the badger, *Taxidea taxus*. Trans. Illinois Acad. Sci., 50: 233–234. August 19, 1958.

HOOIJER, D. A. Mammals and correlation of the "Black Bones" of the Schelde Estuary with those of the Red Crag. Geol. & Mijnb., n.s., 19: 255–256. July, 1957.

HOOIJER, D. A. An Early Pleistocene mammalian fauna from Bethlehem. Bull. British Mus. (Nat. Hist.), Geol., 3 (8): 265–292, pls. 32–35. August, 1958.

HOWARD, WALTER E. The rabbit problem in New Zealand. New Zealand Dept. Sci. & Indust. Research, Wellington, Information Ser., No. 16, pp. 1–47, illus. 1958.

HUENECKE, HOWARD S., ARNOLD B. ERICKSON, AND WILLIAM H. MARSHALL. Marsh gases in muskrat houses in winter. Jour. Wildlife Management, 22 (3): 240–245, illus. July, 1958.

IMAIZUMI, Y. Collections of the marine mammal in Japanese Museums. Nat. Sci. and Museums, Tokyo, 25 (5–6): 1–9. 1958. (In Japanese.)

INNIS, ANNE CHRISTINE. The behaviour of the giraffe, *Giraffa camelopardalis*, in the eastern Transvaal. Proc. Zool. Soc. London, 131 (2): 245–278, pl. 1. September 19, 1958.

ISMAGILOV, M. I. The geographic distribution of rodents in the Betpak-Dala desert. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (2): 61–69. 1958. (In Russian, with English summary.)

JACKSON, HARTLEY H. T. The return of the vanishing musk oxen. Ann. Rept. Smithsonian Inst., Washington, 1957: 381–389, pls. 1–2. 1958.

JACZEWSKI, ZBIGNIEW. Reproduction of the European bison, *Bison bonasus* (L), in reserves. Acta Theriologica, Inst. Zool. Polska Akad. Nauk, Warsaw, 1 (9): 333–376, pls. 19–22, tables 1–25. June 20, 1958.

JONES, J. KNOX, JR. The type locality and nomenclatorial status of Peromyscus maniculatus nebrascensis (Coues). Proc. Biol. Soc. Washington, 71: 107–112. July 16, 1958.

JONES, MILTON B., AND WILLIAM M. LONGHURST. Overhanging deer fences. Jour. Wildlife Management, 22 (3): 325–326, illus. July, 1958.

JONSGÅRD, ÅGE. Taxation of fin whales (Balaenoptera physalus (L.)) at land stations on the Norwegian West Coast. Norsk Hvalfangst-Tidende (Norwegian Whaling Gazette), 47 (9): 433–439. September, 1958.

JOUFFROY, F. K., AND J. LESSERTISSEUR. Notes sur la musculature de la main et du pied d'un orang-outan (*Pongo pygmaeus* Hoppius). Bull. Mus. Nat. Hist. Nat., Paris, ser. 2, 30 (2): 111–122. July 15, 1958.

KAHLKE, HANS-DIETRICH. Die Cervidenreste aus den altpleistozänen Tonen von Voigtstedt bei Sangerhausen. Abhandl. Deutschen Akad. Wiss., Berlin, 1956 (9): 1–51, illus. March 30, 1958.

KLIMSTRA, W. D., AND E. L. CORDER. Food of the cottontail in southern Illinois. Trans. Illinois Acad. Sci., 50: 247–256. August 19, 1958.

KNOBEL, R. Present day status of certain ungulates in the Union of South Africa. Mammalia, Paris, 22 (3): 498–503. September, 1958.

KOCH, WALTER. Über aussterbende Haustierrassen. Zool. Garten, 24 (1–2): 42–44. 1958.

KOOPMAN, KARL F. A fossil vampire bat from Cuba. Breviora Mus. Comp. Zool., 90: 1–4. July 30, 1958.

KOWALSKI, KAZIMIERZ. Fledermausforschung in Polen. Bioloski Glasnik, 10 (3–4): 209–215, pls. 1–4. 1957.

KOWALSKI, KAZIMIERZ. Pleistocene *Microtinae* (*Rodentia, Mammalia*) from Dziadowa Skała-cave in Poland. Acta Zool. Cracoviensia, Inst. Zool. Polska Akad. Nauk, 2 (32): 805–823. August 30, 1958. (In Polish, with Russian and English summaries.)

KÜHLHORN, FRIEDRICH. Körper- und Organgewichte normaler und verhungerter Kapuzineraffen, *Cebus apella* (Linné, 1758). Säugetierk. Mitteil., 6 (3): 107–113. July 1, 1958.

KURTEN, BJÖRN. The bears and hyenas of the Interglacials. Quaternaria, 4: 1–13. 1957.

KURTEN, BJÖRN. A note on the age of the Dhok Pathan zone of the Siwalik series (India). Acta Univ. Stockholm, Contrib. Geol., 2 (2): 29–30. September 15, 1958.

LANDAU, B. R., AND A. R. DAWE. Respiration in hibernation. Amer. Jour. Physiol., 194 (1): 75–82. July, 1958.

LANG, E. M. Zur Haltung des Strandwolfes (*Hyaena brunnea*). Zool. Garten, 24 (1–2): 81–90, illus. 1958.

LAYNE, JAMES N. A simple and inexpensive small animal cage for laboratory use. Turtox News, General Biological Supply House, Chicago, 36 (8): 208–209. August, 1958.

LEVY, CHARLES KINGSLEY. Mammalian responses to total body irradiation. Turtox News, General Biological Supply House, Chicago, 36 (9): 226–227. September, 1958.

LIKHACHEV, G. N. A survey of the number of foxes in the area of the Tula Abatis. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (1): 15–21. 1958. (In Russian, with English summary.)

LITTLE, C. C. Coat color genes in rodents and carnivores. Quarterly Rev. Biol., 33 (2): 103–137. June, 1958.

LOVAAS, ALLAN L. Mule deer food habits and range use, Little Belt Mountains, Montana. Jour. Wildlife Management, 22 (3): 275–283, illus. July, 1958.

LYMAN, C. P., L. P. WEISS, REGINA C. O'BRIEN, AND ADELE A. BARBEAU. The effect of hibernation on the replacement of blood in the golden hamster. Jour. Exper. Zool., Philadelphia, 136 (3): 471–486. December, 1957.

LYMAN, C. P. O_2 consumption, body temperature and heart rate of woodchucks entering hibernation. Amer. Jour. Physiol., 194 (1): 83–91. July, 1958.

MATTHEY, R. La position des genres *Ellobius* Fischer et *Prometheomys* Satunin dans la systematique des microtines.—Le pointe de vue chromosomique. Rev. Suisse Zool., 65 (2): 377–383. August, 1958.

MAYER, WILLIAM V., AND SOL BERNICK. Comparative histochemistry of selected tissues from active and hibernating arctic ground squirrels, *Spermophilus undulatus*. Jour. Cellular & Comp. Physiol., 50 (2): 277–292. October, 1957.

MAYER, WILLIAM V., AND SOL BERNICK. Comparative histological studies of the stomach, small intestine, and colon of warm and active and hibernating arctic ground squirrels, Spermophilus undulatus. Anat. Record, Philadelphia, 130 (4): 747–757. April, 1958.

MCCLURE, H. ELLIOTT. Wildlife conservation problems in southeast Asia, a report on the Ninth Pacific Science Congress. Jour. Wildlife Management, 22 (3): 315–316. July, 1958.

MCCRAE, JAMES D. Experimental breeding. (Genetics of the feline.) Caribou Publ. Co., Caribou, Maine, pp. 1–131, illus. 1955.

MCKEEVER, STURGIS. Reproduction in the opossum in southwestern Georgia and northwestern Florida. Jour. Wildlife Management, 22 (3): 303. July, 1958.

MCLAREN, I. A. The biology of the ringed seal (*Phoca hispida* Schreber) in the eastern Canadian Arctic. Bull. Fisheries Res. Board Canada, no. 118, pp. vii + 97. 1958.

MELDRUM, G. K., J. T. BIGNELL, AND IAN ROWLEY. The use of sodium fluoroacetate (Compound 1080) for the control of the rabbit in Tasmania. Australian Veterinary Jour., 33 (8): 186–196. August, 1957.

MISLIN, H., AND H. HELFER. Vergleichende quantitativ-anatomische Untersuchungen an glatten Muskelzellen der Flughautgefässe (Chiroptera). Rev. Suisse Zool., 65 (2): 384–389. August, 1958.

MISONNE, XAVIER. Faune du Tertiaire et du Pleistocene inferieur de Belgique (Oiseaux et Mammifères). Bull. Inst. Roy. Sci. Nat. Belgique, 34 (5): 1–36, map. February, 1958.

MOHI-UD-DIN, A. Studies in modified growth in mammals. Part I. Pakistan Jour. Sci., 9 (6): 261–265. November, 1957.

MOHLER, S. R., D. R. COLANDER, AND M. M. GUEST. Distribution of urokinase among the common mammals. Amer. Jour. Physiol., 192 (1): 185–190. January, 1958.

MOORE, JOSEPH CURTIS. A beaked whale from the Bahama Islands and comments on the distribution of *Mesoplodon densirostris*. Amer. Mus. Novitates, New York, 1897: 1–12. July 22, 1958.

MOSIER, H. D., AND C. P. RICHTER. Response of the glomerulosa layer of the adrenal gland of wild and domesticated Norway rats to low and high salt diets. Endocrinology, 62 (3): 268–277. March, 1958.

MOTTL, MARIA. Bericht über die neuen Menschenaffenfunde aus Österreich, von St. Stefan im Lavanttal, Kärnten. Carinthia II, Klagenfurt, 67: 39–84, 5 folding tables. November, 1957. (New: *Dryopithecus fontani carinthiacus*.)

MUNRO, J. A. The birds and mammals of the Creston region, British Columbia: a supplement. Rept. British Columbia Provincial Mus., Victoria, 1957: C65-C82. 1958.

MYERS, K. Further observations on the use of field enclosures for the study of the wild rabbit, *Oryctolagus cuniculus* (L.). C.S.I.R.O. Wildlife Research, Canberra, Australia, 3 (1): 40–49, pl. 1. 1958.

MYKYTOWYCZ, R. The transmission of myxomatosis by *Simulium melatum* Wharton (Diptera: Simuliidae). C.S.I.R.O. Wildlife Research, Canberra, Australia, 2 (1): 1–4. 1957. (Rabbits.)

MYKYTOWYCZ, R. Contact transmission of infectious myxomatosis of the rabbit, *Oryctolagus cuniculus* (*L.*). C.S.I.R.O. Wildlife Research, Canberra, Australia, 3 (1): 1–6. 1958.

MYKYTOWYCZ, R. Social behaviour of an experimental colony of wild rabbits, *Oryctolagus cuniculus* (L.). I. Establishment of the colony. C.S.I.R.O. Wildlife Research,

MYKYTOWYCZ, R., AND IAN ROWLEY. Continuous observations of the activity of the wild Canberra, Australia, 3 (1): 7–25. 1958.
rabbit, *Oryctolagus cuniculus* (*L.*), during 24-hour periods. C.S.I.R.O. Wildlife Research, Canberra, Australia, 3 (1): 26–31. 1958.

NABI, SAYYID AHMED ABDEL. Protection of game in the Sudan. Sudan Notes & Records, 37: 119–121. 1956.

NIKITINA, N. A. Peculiarities of territory utilization by the mice, Apodemus agrarius Pall. Zool. Zhurnal, Moscow, 37 (9): 1397–1408. 1958. (In Russian with English summary.)

NOVICK, ALVIN. Orientation in paleotropical bats. II. Megachiroptera. Jour. Exper. Zool., 137 (3): 443–462. April, 1958.

OLSEN, STANLEY J. A new beak-jawed mastodont from Florida. Jour. Paleontol. Soc. India, Lucknow, 2: 131–135. 1957. (New: *Rhynchotherium simpsoni*.)

PAK POY, R. K. F. Electron microscopy of the marsupial renal glomerulus. Australian Jour. Exper. Biol. & Med. Sci., Adelaide, 35 (5): 437–448. October, 1957. (*Trichosurus*.)

PAYNE, D. D., AND D. C. O'MEARA. *Sarcoptes scabei* infestation of a porcupine. Jour. Wildlife Management, 22 (3): 321–322, illus. July 1, 1958.

PETERLE, TONY J. Game management in Scotland. Jour. Wildlife Management 22 (3): 221–231, illus. July, 1958.

PICKVANCE, T. J. A note on the pine marten (*Martes martes*) in Worcestershire. Proc. Zool. Soc. London, 131 (2): 326–327. September 19, 1958.

PIECHOCKI, R. Tollwütige Wildkatze aus dem Harz. Säugetierk. Mitteil., 6 (3): 122. July 1, 1958.

POURNELLE, GEORGE H. Apes fascinate. Zoonooz, Zool. Soc. San Diego, 31 (8): 10–13, illus. August, 1958. (Anthropoids.)

RACENIS, JUAN. Lista provisional de los quirópteros (murciélagos) de Venezuela. *in*: Torrealba, J. F., Investigaciones sobre la Enfermedad de Chagas en San Juan de los Morros. Imprenta Nacional, Caracas, fasc. iv, pp. 107–119. 1958.

RAUSCH, ROBERT. Some observations on rabies in Alaska, with special reference to wild Canidae. Jour. Wildlife Management, 22 (3): 246–260. July, 1958.

REIG, OSVALDO A. Nota previa sobre los marsupiales de la formación chasicó. Ameghiniana, 1 (3): 27–31, illus. December, 1957. (New: *Chasicostylus, C. castroi.*)

REIG, OSVALDO A. Sobre una nueva especie del género *"Chapalmatherium"* (Rodentia, Hydrochoeridae) del Pliocene del Rio Quequén Salado. Physis, 21 (60): 32–40, illus. 1958. (New: *C. irenense.*)

REINVALDT, EDV. Bemerkungen zur Zeichnung der Gelbhalsmaus (*Apodemus flavicollis* Melch.). Fauna och Flora, Stockholm, 53 (1–2): 1–8. 1958. (In Swedish, with German summary.)

REINWALDT, EDWIN. Über- und unterzählige Schneidezähne bei Musteliden. Säugetierk. Mitteil., 6 (3): 97–100, illus. July 1, 1958.

REYNOLDS, HUDSON G. The ecology of the Merriam kangaroo rat (*Dipodomys merriami* Mearns) on the grazing lands of southern Arizona. Ecological Monographs, 28: 111–127, illus. April, 1958.

ROBERTS, AUSTIN. The mammals of the Wonderboom Nature Reserve. Fauna & Flora, Transvaal, Pretoria, 7: 124–129, illus. 1958.

ROGERS, TERENCE A. The metabolism of ruminants. Scientific American, 198 (2): 34. February, 1958.

ROMANKOWOWA, ANNA. Generic and specific differences of the autopodial skeleton in rodents (*Simplicidentata*). Zoologica Poloniae, 8 (2–3): 271–282. 1957. (In Polish, with English summary.)

ROTHSCHILD, MIRIAM. A further note on the increase of hares (*Lepus europaeus*) in France. Proc. Zool. Soc. London, 131 (2): 328–329. September 19, 1958.

ROWE, F. P. Some observations on harvest mice from the corn ricks of a Hampshire farm. Proc. Zool. Soc. London, 131 (2): 320–323. September 19, 1958.

ROWLEY, IAN. Field enclosure experiments on the technique of poisoning the rabbit, *Oryctolagus cuniculus* (L.). I. A study of total daily take of bait during free-feeding. C.S.I.R.O. Wildlife Research, Canberra, Australia, 2 (1): 5–18. 1957.

ROWLEY, IAN. Behaviour of a natural rabbit population poisoned with "1080." C.S.I.R.O. Wildlife Research, Canberra, Australia, 3 (1): 32–39, pl. 1. 1958.

RUDY, MELVIN. Detroit Zoological Park animal squeeze cage. Zool. Garten, 24 (1–2): 60–65, illus. 1958.

RUSSELL, LORIS S. A horse astragalus from the Hand Hills conglomerate of Alberta. Nat. Hist. Papers, Nat. Mus. Canada, 1: 1–3, illus. August 18, 1958.

RYŠAVÝ, BOHUMIL, AND ZDENEK JAROŠ. Fund von interessanten parasitischen Würmern beim indischen Elefanten (*Elephas maximus* L.). Zool. Garten, 24 (1–2): 23–26, illus. 1958.

SA E MELO CRISTINO, J. J. DE. Statut des ongulés en Guinée portugaise. Mammalia, Paris, 22 (3): 387–389. September, 1958.

SCHÄUFFELEN, O. Messungen der Körpertemperatur bei zwei indischen Elefantenkühen. Zool. Garten, 24 (1–2): 109–110. 1958.

SCHMIDT-NIELSEN, BODIL. Urea excretion in mammals. Physiol. Reviews, 38 (2): 139–168. April, 1958.

SCHOFIELD, RAYMOND D. Litter size and age ratios of Michigan red foxes. Jour. Wildlife Management, 22 (3): 313–315. July, 1958.

SCHULLER, LINDE. Dackelbeiniges Rotfuchs-♀. Säugetierk. Mitteil., 6 (3): 121–122, illus. July 1, 1958.

SCHULZE, W. Penislähmung bei einem Warzenschwein. Zool. Garten, 24 (1–2): 111. 1958.

SHEBBEARE, E. O. Origin of dogs. Jour. Bengal Nat. Hist. Soc., 29 (3): 84–88. December, 1957.

SHIBATA, TOSHI, AND KOICHI TERAJIMA. Bats of Miura Peninsula, Japan. Sci. Repts. Yokosuka City Mus., 3: 44–52. March, 1958.

SINGER, RONALD, AND D. A. HOOIJER. A Stegolophodon from South Africa. Nature, London, 182 (4628): 101–102. July 12, 1958.

SMITH, HOBART M. The phylogeny of hair and epidermal scales. Turtox News, General Biological Supply House, Chicago, 36 (3): 82–84. March, 1958.

SMITH, ROBERT LEO. Conifer plantations as wildlife habitat. New York Fish & Game Jour., 5 (2): 101–132. July, 1958.

SORIA, MIGUEL FERNANDO. Anatomiá descriptiva de la cabeza osea, en el género Cebus. Revista Mus. Argentino Cien. Nat. "Bernardino Rivadavia," 3 (7): 375–468. 1957.

SOUTH, F. E., AND H. JEFFAY. Alterations in serum proteins of hibernating hamsters. Proc. Soc. Exper. Biol. & Med., 98 (4): 885–887. August–September, 1958.

SOUTHWICK, CHARLES H. Population characteristics of house mice living in English corn ricks: density relationships. Proc. Zool. Soc. London, 131 (2): 163–175. September 19, 1958.

STAINS, HOWARD J. A clue to spring molt in raccoons as revealed in analysis of scats. Trans. Illinois Acad. Sci., 50: 257–258. August 19, 1958.

STANNARD, LEWIS J., JR., AND LYSLE R. PIETSCH. Ectoparasites of the cottontail rabbit in Lee County, northern Illinois. Biol. Notes Illinois Nat. Hist. Surv., 38: 1–18. June, 1958.

STEINBACHER, GEORG. Einige Boebachtungen bei der Geburt von Cameliden. Säugetierk. Mitteil., 6 (3): 120–121. July 1, 1958.

STROGANOVA, A. S. On the ecology of the Caucasian squirrel Sciurus (Tenes) anomalus Güld. 1792. Trudy Zool. Inst. Akad. Sci. SSSR, 25: 304–320. 1958. (In Russian).

SVIRIDENKO, P. A. Method of establishing the number of progeny in a brood of rodents according to placental stains. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (2): 49–54. 1958. (In Russian, with English summary.)

SWYNNERTON, G. H. Fauna of the Serengeti National Park. Mammalia, Paris, 22 (3): 435–450. September, 1958.

SYROECHKOVSKII, E. E. Alteration of geographical appearance of the water reservoirs in Terek–Sulak plain as a factor affecting the distribution and population density of the ondatra. Zool. Zhurnal, Moscow, 37 (8): 1244–1251. August, 1958. (In Russian, with English summary.)

SZAFLARSKI, JERZY. H-Avitaminose bei *Citellus suslica*. Zool. Garten, 24 (1–2): 101–102, illus. 1958.

TABER, RICHARD D., AND RAYMOND F. DASMANN. The black-tailed deer of the chaparral. Its life history and management in the North Coast Range of California. Game Bull. California Dept. Fish & Game, 8: 1–163, illus. 1958.

TAYLOR, J. I. The position of wild ungulates in Nigeria. Mammalia, Paris, 22 (3): 394–398. September, 1958.

THENIUS, ERICH. Gewiehjugendstadien des eiszeitlichen Riesenhirsches, *Megaceros giganteus* (Blum.), und ihre phylogentische Bedeutung. Acta Zool. Cracoviensia, Inst. Zool. Polska Akad. Nauk, 2 (30): 707–720. March 31, 1958.

THOMAS, WARREN D. Observations on the breeding in captivity of a pair of lowland gorillas. Zoologica, New York Zool. Soc., 43 (3): 95–104, pls. 1–3. November 20, 1958.

THORN, N. A. Mammalian antidiuretic hormone. Physiol. Reviews, 38 (2): 169–195. April, 1958.

TONG, E. H. Père David's deer, 1957. Proc. Zool. Soc. London, 131 (2): 318–319. September 19, 1958. (Census.)

TORREALBA, J. F. Comprobacion de un nuevo reservorio silvestre de Tripanosoma cruzi, Chagas. 1909: el Caluromys trinitatis Thomas. *in*: Torrealba, J. F. Investigaciones sobre la Enfermedad de Chagas en San Juan de los Morros, Imprenta Nacional, Caracas, fasc. iv, pp. 97–99. 1958.

TORREALBA, JOSE FRANCISCO, ET AL. Acerca de mas especies y sub-especies de quirópteros con tripanosomas parecidos al Tripanosoma cruzi. *in*: Torrealba, J. F. Investigaciones sobre la Enfermedad de Chagas en San Juan de los Morros, Imprenta Nacional, Caracas, fasc. iv, pp. 101–107. 1958.

TSALKIN, V. I. The mammals of ancient Latvia. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (3): 5–17. 1958. (In Russian, with English summary.)

ULLMANN, E. VON, AND A. HARGREAVES. New coat colours in domestic cats. Proc. Zool. Soc. London, 130 (4): 606–609. June 20, 1958.

VAN DEUSEN, HOBART M., AND RUSSELL F. PETERSON. Chiroptera of New Guinea. Natural History, Amer. Mus. Nat. Hist., 67 (8): 452–459, illus. October, 1958.

VAN DRESSER, CLEVELAND. Have the Key deer been saved? Florida Wildlife, Tallahassee, 12 (3): 24–25, 38. August, 1958.

VERESHCHAGIN, N. K. Kavkazskii los' (Alces alces caucasicus n. ver. subsp. nova) i materialy k istorii losei na kaukaze. Zool. Zhurnal Akad. Nauk SSSR, 34 (2): 460–463. April 4, 1955.

VERSCHUREN, JACQUES. La statut actuel des grands ongulés du Congo belge et du Ruanda-Urundi principalement dans les Parcs nationaux du Congo belge. Mammalia, Paris, 22 (3): 406–417. September, 1958.

VILLALTA, JOSE F. DE, AND M. CRUSAFONT-PAIRO. Dos nuevas especies de *Hipparion* del Pikermiense español. Cursi Conf. Inst. "Lucas Mallada," fasc. 4: 65–69. 1957. (New: *H. periafricanum, H. gromovae.*)

VINOGRADOV, B. S. On the structure of external genitalia in white-toothed shrews (genus Crocidura, Insectivora, Mammalia) as a classificatory. Zool. Zhurnal, Moscow, 37 (8): 1236–1243. August, 1958. (In Russian, with English summary.)

VIRET, JEAN. Le loess a bancs durcis de Saint-Vallier (Drome) et sa faune de mammifères villafranchiens. Nouv. Arch. Mus. Hist. Nat. Lyon, fasc. 4, pp. 1–200, pls. 1–33. 1954. (New: *Hyaena donnezani, Panthera schaubi.*)

VORONTSOV, N. N. Importance de l'etude des compositions chromosomes pour la systematique des mammiféres. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (2): 5–36. 1958. (In Russian, with French summary.)

VORONTSOV, N. N. Stroeni yazyka palearkticheskikh khomyakov (Cricetinae). Trudy Zool. Inst. Akad. Sci. SSSR, 25: 321–335. 1958. (Structure of the tongue of Palaearctic hamsters.)

WARNER, E. D. The organogenesis and early histogenesis of the bovine stomach. Amer. Jour. Anat., 102 (1): 33–63. January, 1958.

WETTSTEIN, OTTO. Zum ersten Nachweis des Baumschläfers aus Nordtirol v. H. Psenner. Säugetierk. Mitteil., 6 (3): 122. July 1, 1958.

WIMSATT, W. A. The allantoic placental barrier in Chiroptera: A new concept of its organization and history. Acta Anatomica, Basel, 32 (1–2): 141–186. 1958.

WOO, JU-KANG. The first discovery of *Dryopithecus* teeth in China and its significance. Acta Palaeontol. Sinica, 6 (2): 119–121, illus. May, 1958. (New: *D. keiyuanensis.*)

WOODS, JACK T. The extinct marsupial genus Palorchestes Owen. Mem. Queensland Mus., 13 (4): 177–193. July 28, 1958.

YABLOKOV, A. V. The dental structure and type of teeth of cetaceans. Bull. Moscow Obshch. Ispyt. Prirodi, 63 (2): 37–48. 1958. (In Russian, with English summary.)

YANUSHKO, P. A. Population dynamics of Cervus elaphus brauneri (Scharlemagne). Zool. Zhurnal, Moscow, 37 (8): 1128–1235. August, 1958. (In Russian, with English summary.)

ZUHRT, RAINER. Zahnfleischerkrankung beim Igel als Todesursache. Zool. Garten, 24 (1–2): 74–80, illus. 1958.

ZUKOWSKY, LUDWIG. Erfahrungen mit einem Elektrozaungerät an einer Affenfreianlage. Zool. Garten, 24 (1–2): 105–198, illus. 1958.

COMMENTS AND NEWS

RESEARCH GRANTS

The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the life sciences is May 15, 1959. Proposals received prior to that date will be reviewed at the summer meetings of the Foundation's advisory panels and disposition will be made approximately four months following the closing date. Proposals received after the May 15, 1959, closing date will be reviewed following the fall closing date of September 15, 1959. Inquiries should be addressed to the National Science Foundation, Washington 25, D.C.

GRANTS FOR MUSEUM STUDIES

The Karl P. Schmidt Fund has modest sums available to assist persons wishing to study at the Chicago Natural History Museum. Grants will be made for study in any of the four fields encompassed by the museum: anthropology (with a natural history orientation), botany, geology (including paleontology), and zoology. An applicant should describe the study proposed in brief terms, state the length of time he wishes to study at the museum and the amount of money needed, and name one reference. Applications should be mailed to: Chairman, The Karl P. Schmidt Fund, c/o Chicago Natural History Museum, Roosevelt Road and Lake Shore Drive, Chicago 5, Illinois.

CHANGES OF ADDRESS

Members are reminded that changes of address for forthcoming issues of the Journal are not effective unless received by the Secretary–Treasurer by the 1st of February, May, August and November, respectively. It may not be generally known that the Society is required to pay return and remailing postage, as well as a penalty assessed by the Postoffice for rehandling second-class mail, and all this adds considerably to our expenses. In this connection, the Secretary–Treasurer will appreciate any information leading to the location and apprehension of Richard L. Farrand, whose mail has recently been returned.

39th ANNUAL MEETING

Plans may still be made for attending the 1959 Annual Meeting of the Society at Washington, D.C., June 22–25. See full details in the February issue, page 164.

NOMENCLATURAL PUBLICATIONS AVAILABLE

Recent publications listed below may be ordered from The International Trust for Zoological Nomenclature, Publications Office, 41 Queen's Gate, London S.W. 7, England. The current rate of exchange of the British pound (April 20) is $2.82. Supplements to these publications will continue.

OFFICIAL LISTS of valid names and accepted works:	
Specific Names in Zoology, 224 pp.	£ 2. 5. 0
Generic Names in Zoology, 240 pp.	2. 10. 0
Family-Group Names in Zoology	0. 15. 0
Works Approved as Available	0. 7. 6
OFFICIAL INDEXES of invalid names and rejected works:	
Specific Names in Zoology, 88 pp.	1. 0. 0
Generic Names in Zoology, 144 pp.	1. 10. 0
Family-Group Names in Zoology	0. 15. 0
Works in Zoological Nomenclature	0. 7. 6
Stout loose-leaved binder (2 will hold 8 LISTS and INDEXES above)	0. 15. 0

DEATHS REPORTED

Robert T. Moore, October, 1958

Paul E. Tovey, December 25, 1958

AMERICAN SOCIETY OF MAMMALOGISTS

BYLAWS

ARTICLE I. NAME AND OBJECTS

Sec. 1. This Society shall be known as the American Society of Mammalogists.

Sec. 2. The object of the Society shall be the promotion of the interests of mammalogy by holding meetings, issuing a serial or other publications, aiding research, and engaging in such other activities as may be deemed expedient.

ARTICLE II. MEMBERSHIP

Sec. 1. The Society shall consist of Members, Honorary Members, and Patrons.

Sec. 2. Any person may become a Member upon recommendation of two Members and election at the next annual stated meeting, or by special election at other times by a two-thirds vote of the Directors (which may be obtained by correspondence). Members are entitled to vote for all Officers and to receive the serial publication of the Society.

Sec. 3. Honorary Members shall be elected by a majority vote of the Society upon unanimous recommendation of the Directors in recognition of distinguished service to mammalogy. They shall be exempt from all dues and shall be entitled to all privileges of Members.

Sec. 4. On payment of one thousand dollars, any person recommended by the Board of Directors may be elected a Patron and shall be entitled to all the privileges of a Member, shall receive all publications of the Society, and shall be exempt from membership fees.

ARTICLE III. OFFICERS

Sec. 1. Elective Officers of the Society shall be a President, two Vice-Presidents, and a Recording Secretary. These, together with the Secretary-Treasurer, the Editor, the Ex-Presidents, and ten persons elected from the Society at large, shall constitute the Board of Directors of the Society.

Sec. 2. Officers shall be elected annually and shall be eligible for reelection; they shall perform their duties until their successors shall qualify. The Secretary-Treasurer and the Editor shall be appointed by the Directors, provided, however, that a petition signed by 20 per cent or more of the Members in good standing at any annual stated meeting will be sufficient to require the Board of Directors to submit a ballot to the Members present at said meeting to determine their approval or disapproval of either incumbent. Five Directors shall be elected annually from the Society at large and shall serve for two years. Officers shall be elected by a majority vote at the annual meeting, and their official term shall commence at the close of the meeting at which they are elected.

Sec. 3. Vacancies among the Officers or Directors may be filled temporarily by appointment by the Directors, and persons so appointed shall hold office until their successor shall have been elected.

Sec. 4. The Secretary-Treasurer shall be the executive officer of the Society under the general direction and subject to regulations of the Board of Directors. He shall be bonded at the Society's expense in the amount specified by the Board of Directors. He shall conduct the business affairs of the Society, issue notices of annual or special meetings, and present a monthly financial report to the President and an annual report of his activities to the Society at the annual stated meeting. He shall, subject to regulations of the Board of Directors, be responsible for all funds of the Society, except for the permanent funds which shall be under the supervision of the Board of Trustees. The general fund accounts shall be subject to the signature of the Secretary-Treasurer.

ARTICLE IV. MEETINGS

Sec. 1. An annual stated meeting shall be held in accordance with the action of the Society at the preceding annual meeting. Due notice of such meetings shall be given by the Secretary-Treasurer.

Sec. 2. A special meeting of the Society may be called at any time by order of the Directors, provided that notice of the purpose and date of the meeting be given at least thirty days in advance.

Sec. 3. Sections of the Society may be organized by five or more Members in any locality, with the approval of the Directors of the Society in each case, for the purpose of holding meetings for the presentation of papers or discussion.

Sections may have their own officers and rules, but such rules shall not conflict with the Bylaws of the Society. Each section shall present to the Society an annual report of its activities.

ARTICLE V. QUORUM

Twenty shall constitute a quorum of the Society and five a quorum of the Directors.

ARTICLE VI. AMENDMENTS

Amendments to these Bylaws, recommended by the Directors, may be adopted at any annual stated meeting by a two-thirds vote of the Members present, provided that notice of each proposed amendment has been sent to each Member two months before the meeting.

ARTICLE VII. RULES

Upon recommendation of the Directors, Rules may be adopted, amended, or repealed at any annual stated meeting by a majority vote.

ARTICLE VIII. FEES AND ACCOUNTS

Sec. 1. Annual dues for Members shall be four dollars, payable in advance.

Sec. 2. Any Member, upon payment of one hundred dollars at one time, or in four payments of twenty-five dollars in four consecutive years, shall be entitled to life membership, and shall be exempt from membership dues from the time of the initial payment.

Sec. 3. All moneys received from Life Members and Patrons in consideration of their election as such, and all gifts for undesignated purposes, shall be invested as a permanent fund, the income of which may be used for special purposes as directed by a three-fourths vote of the Directors. The accounts of the Secretary-Treasurer shall be audited, as directed by the President, at the close of each year before presentation at the annual stated meeting of the Society.

ARTICLE IX. FUNDS AND TRUSTEES

Sec. 1. Bequests and trusts having for their object the advancement of mammalogy or the welfare of the American Society of Mammalogists may be accepted and administered by the Society. Before acceptance of any such trust the Directors shall consider the object of the trust and all conditions or specifications attached thereto, and shall make a report to the Society for its action.

Sec. 2. A board of three Trustees elected by the Directors shall hold all the funded property of the Society in trust with power to sell and to reinvest according to their judgment. One Trustee shall be elected for a term of three years at each annual meeting. Vacancies among the Trustees may be filled by election at any time by a majority vote of the Directors (which may be obtained by correspondence).

RULES

RULE I. ELECTION OF OFFICERS

The election of Officers shall be as follows:

Nominations shall be made from the floor for Officers in the following order: President, Vice-Presidents (two), and Recording Secretary. Nominations shall be made and closed for each office before proceeding to the nominations for the next office herein above specified. Elections shall be by secret ballot and each Member shall cast a vote for one nominee for each office. Nominees receiving a majority of votes shall be declared elected. If the ballot results in less than a majority of votes cast for one nominee for a given office, a second ballot shall be cast for the nominees receiving the two highest numbers of votes.

Following the election of Officers, the five Directors for membership in the Council shall be nominated and elected in the same way as the President except that the five nominees for the Council who receive the highest numbers of votes shall be declared elected.

RULE II. ORDER OF BUSINESS

The order of business at the annual stated meeting, unless changed by a two-thirds vote of Members present, shall be as follows:

1. Reading and approval of the minutes of the previous meeting.
2. Appointment of temporary committees and tellers.
3. Report of the Secretary-Treasurer.
   a. Statistical summary.
   b. Election of nominees to membership.
   c. Financial report.
4. Report and recommendations of the Board of Directors.
5. Consideration of amendments.
6. Election of Officers and Directors and reports of committees.
7. New and unfinished business.
   a. Reports of representatives to other societies.
   b. Presentation of resolutions.
   c. Selection of next place of meeting.
   d. Other business.
8. Adjournment.

RULE III. DELINQUENTS

Members whose dues are in arrears for more than one year shall not be entitled to receive the *Journal of Mammalogy*.

The names of Members whose dues are in arrears for more than two years shall be presented to the Directors for action.

Founded 3 April 1919

Year	President	Vice-Presidents	Corres. Secretary	Treasu
1919	C. Hart Merriam*	E. W. Nelson,* Wilfred H. Osgood*	H. H. T. Jackson	Walter P. T
1920	C. Hart Merriam*	E. W. Nelson,* Wilfred H. Osgood*	H. H. T. Jackson	J. W. Gill
1921	E. W. Nelson*	Gerrit S. Miller, Jr.,* W. H. Osgood*	H. H. T. Jackson	Arthur J. P
1922	E. W. Nelson*	Gerrit S. Miller, Jr.,* W. H. Osgood*	H. H. T. Jackson	Arthur J. P
1923	E. W. Nelson*	Gerrit S. Miller, Jr.,* W. H. Osgood*	H. H. T. Jackson	Arthur J. P
1924	Wilfred H. Osgood*	Glover M. Allen,* W. D. Matthew*	H. H. T. Jackson	Arthur J. P
1925	Wilfred H. Osgood*	Glover M. Allen,* W. D. Matthew*	A. Brazier Howell	Arthur J. P
1926	W. D. Matthew*	Glover M. Allen,* H. E. Anthony	A. Brazier Howell	Arthur J. P
1927	Glover M. Allen*	T. S. Palmer,* Witmer Stone*	A. Brazier Howell	Arthur J. P
1928	Glover M. Allen*	T. S. Palmer,* Witmer Stone*	A. Brazier Howell	Arthur J. P
1929	Witmer Stone*	M. W. Lyon, Jr.,* T. S. Palmer*	A. Brazier Howell	Arthur J. P
1930	Witmer Stone*	M. W. Lyon, Jr.,* T. S. Palmer*	A. Brazier Howell	Viola S. Sc
1931	M. W. Lyon, Jr.*	H. E. Anthony, T. S. Palmer*	Francis Harper	Viola S. Sc
1932	M. W. Lyon, Jr.*	H. E. Anthony, T. S. Palmer*	Robert T. Hatt	Viola S. Sc
1933	Vernon Bailey*	H. E. Anthony, T. S. Palmer*	Robert T. Hatt	Viola S. Sc
1934	Vernon Bailey*	H. E. Anthony, T. S. Palmer*	Robert T. Hatt	Viola S. Sc
1935	Harold E. Anthony	Joseph Grinnell,* Edward A. Preble*	William H. Burt	Viola S. Sc
1936	Harold E. Anthony	Joseph Grinnell,* Edward A. Preble*	William H. Burt	Viola S. Sc
1937	Joseph Grinnell*	H. H. T. Jackson, Edward A. Preble*	William H. Burt	Viola S. Sc
1938	H. H. T. Jackson	A. Brazier Howell, Walter P. Taylor	William B. Davis	Viola S. Sc
1939	H. H. T. Jackson	A. Brazier Howell, Walter P. Taylor	William B. Davis	Viola S. Sc
1940	Walter P. Taylor	E. Raymond Hall, A. Brazier Howell	William B. Davis	Viola S. Sc
1941	Walter P. Taylor	E. Raymond Hall, A. Brazier Howell	Emmet T. Hooper	Viola S. Sc
1942	A. Brazier Howell	Edward A. Goldman,* E. Raymond Hall	Emmet T. Hooper	Viola S. Sc
1943	A. Brazier Howell	Edward A. Goldman,* E. Raymond Hall	Emmet T. Hooper	Viola S. Sc
1944	E. Raymond Hall	Edward A. Goldman,* Edward A. Preble*	Emmet T. Hooper†	Viola S. Sc
1945	E. Raymond Hall	Edward A. Goldman,* Edward A. Preble*	Emmet T. Hooper†	Viola S. Sc
1946	Edward A. Goldman*	R. M. Anderson, Remington Kellogg	Emmet T. Hooper	Viola S. Sc
1947	Remington Kellogg	Lee R. Dice, Tracy I. Storer	D. F. Hoffmeister	Viola S. Sc
1948	Remington Kellogg	Lee R. Dice, Tracy I. Storer	D. F. Hoffmeister	Viola S. Sc
1949	Tracy I. Storer	Lee R. Dice, W. J. Hamilton, Jr.	D. F. Hoffmeister	Viola S. Sc
1950	Tracy I. Storer	Lee R. Dice, W. J. Hamilton, Jr.	D. F. Hoffmeister	Viola S. Sc
1951	W. J. Hamilton, Jr.	William H. Burt, William B. Davis	D. F. Hoffmeister	Viola S. Sc
1952	W. J. Hamilton, Jr.	William H. Burt, William B. Davis	Keith R. Kelson	Viola S. Sc
1953	William H. Burt	Robert T. Orr, George H. H. Tate*	Keith R. Kelson	C. A. Hepp
1954	William H. Burt	William B. Davis, Robert T. Orr	George C. Rinker	C. A. Hepp
1955	William B. Davis	Stephen D. Durrant, Robert T. Orr	George C. Rinker	C. A. Hepp
1956	William B. Davis	Stephen D. Durrant, Robert T. Orr	Bryan P. Glass	C. A. Hepp
1957	William B. Davis	Stephen D. Durrant, Robert T. Orr	Secretary–Treasurer:	Bryan P. G
1958	Robert T. Orr	Stephen D. Durrant, Emmet T. Hooper		Bryan P. G

Honorary Members

1919—Joel Asaph Allen*
1921—E.-L. Trouessart*
1928—Oldfield Thomas*
1928—Max Weber*
1929—Henry Fairfield Osborn*
1930—Clinton Hart Merriam*
1930—Edward William Nelson*
1936—A. W. Anthony*
1936—Wm. Berryman Scott*
1937—Leonard Stejneger*
1941—Gerrit S. Miller, Jr.*
1941—Ernest Thompson Seton*
1942—Marcus Ward Lyon, Jr.*
1947—Rudolph M. Anderson
1947—Angel Cabrera
1951—A. Brazier Howell
1951—T. S. Palmer*
1952—Hartley H. T. Jo
1952—Edward A. Pre
1954—William K. Gre
1954—Walter P. Tayl
1955—Harold E. Anth
1956—Lee R. Dice
1956—Albert R. Shad

In the *Journal*:
- Organization Meeting—vol. 1: 47.
- Articles of Incorporation—vol. 4: 271.
- Bylaws and Rules—vol. 1: 49; vol. 5: 78.
- Allen Memorial Fund—vol. 11: 259.

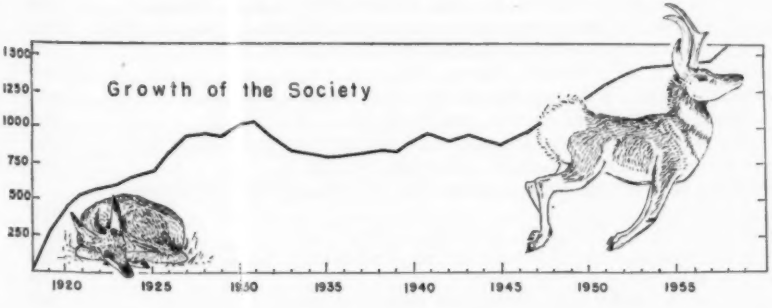
Incorporated 29 April 1920

Secretary	Editor	Journal Vol.	Journal pp.		Annual Meeting		Papers Read	Attendance	Membership
Lane	N. Hollister*			1st	Washington, D. C.	Apr.	6	60	252
Lane	N. Hollister*	1	259	2nd	New York, N. Y.	May	20	70	441
Lane	N. Hollister*	2	254	3rd	Washington, D. C.	May	18	67	527
Lane	N. Hollister*	3	280	4th	New York, N. Y.	May	24	52	555
Lane	N. Hollister*	4	278	5th	Philadelphia, Pa.	May	19	37	586
Lane	N. Hollister*	5	299	6th	Boston, Mass.	Apr.	24	37	646
Lane	H. H. T. Jackson	6	301	7th	Washington, D. C.	Apr.	31	79	700
Lane	H. H. T. Jackson	7	354	8th	New York, N. Y.	Apr.	29	70	857
Lane	H. H. T. Jackson	8	358	9th	Philadelphia, Pa.	Apr.	36	60	942
Lane	H. H. T. Jackson	9	367	10th	Washington, D. C.	Apr.	45	112	971
Lane	H. H. T. Jackson	10	382	11th	Ann Arbor, Mich,	Apr.	39	60	965
Lane	Edward A. Preble*	11	529	12th	New York, N. Y.	May	53	96	1,005
Lane	Edward A. Preble*	12	461	13th	Philadelphia, Pa.	May	30	70	1,017
Lane	Edward A. Preble*	13	402	14th	Washington, D. C.	May	40	120	931
K. Enders	Edward A. Preble*	14	407	15th	Cambridge, Mass.	May	39	66	888
K. Enders	Edward A. Preble*	15	365	16th	New York, N. Y.	May	50	94	824
K. Enders	Edward A. Preble*	16	354	17th	Pittsburgh, Pa.	May	35	71	770
K. Enders	A. Brazier Howell	17	450	18th	Philadelphia, Pa.	May	36	76	801
K. Enders	A. Brazier Howell	18	549	19th	Washington, D. C.	May	34	113	821
T. Orr	Arthur H. Howell*	19	537	20th	Berkeley, Calif.	July	44	114	869
T. Orr	Arthur H. Howell*	20	544	21st†	Baton Rouge, La.	Apr.	39	92	857
T. Orr	Arthur H. Howell*	21	518	22nd	Denver, Colo.	June	34	92	898
T. Orr	William B. Davis	22	483	23rd	Chicago, Ill.	June	37	131	949
Benson	William B. Davis	23	483	24th	New York, N. Y.	Apr.	46	136	908
Benson	William B. Davis	24	533	*Directors met at Washington*			—	—	926
Benson	William B. Davis	25	436	25th	New York, N. Y.	Mar.	—	27	907
Benson	William B. Davis	26	461	*Directors met at Chicago*			—	—	882
T. Orr	William B. Davis	27	426	26th	Pittsburgh, Pa.	Apr.	33	125	918
T. Orr	William B. Davis	28	447	27th	Higgins Lake, Mich.	Aug.	30	120	993
T. Orr	William H. Burt	29	448	28th†	Toronto, Ont.	Apr.	30	114	1,071
T. Orr	William H. Burt	30	476	29th	Washington, D. C.	June	44	110	1,124
T. Orr	William H. Burt	31	506	30th	Yellowstone, Wyo.	June	49	143	1,232
eterson	William H. Burt	32	506	31st	Chicago, Ill.	June	34	96	1,298
eterson	William H. Burt	33	532	32nd	Charleston, S. C.	Apr.	45	84	1,348
eterson	W. Robert Eadie	34	552	33rd	New York, N. Y.	June	36	105	1,407
eterson	W. Robert Eadie	35	652	34th	Estes Park, Colo.	June	46	135	1,423
eterson	W. Robert Eadie	36	617	35th	Los Angeles, Calif.	June	39	135	1,440
eterson	W. Robert Eadie	37	594	36th‡	Higgins Lake, Mich.	June	46	99	1,442
eterson	R. H. Manville	38	574	37th	Lawrence, Kans.	June	65	187	1,460
eterson	R. H. Manville	39	636	38th‡	Tucson, Ariz.	June	47	168	1,578

ued.

† Burt served during Hooper's absence on military duty.

‡ *The Spilogale* issued.



LIST OF MEMBERS

LIST OF MEMBERS OF THE AMERICAN SOCIETY OF MAMMALOGISTS

(Additions have been made to this list to February 11, 1959. Corrections and changes of addresses should be sent to the Secretary-Treasurer, Bryan P. Glass)

* Life Member

Honorary Members

ANDERSON, RUDOLPH M., 58 Driveway, Ottawa, Ontario, Canada ..... (Charter) 1947
ANTHONY, H. E., Amer. Mus. of Nat. Hist., Central Park W at 79th St., New York 24, New York ..... (Charter) 1955
CABRERA, ANGEL, Calle 6, no. 1234-4° A, La Plata, Argentina ..... (Charter) 1947
DICE, LEE R., Lab. of Vert. Biol., Univ. of Michigan, Ann Arbor, Mich. ..... (Charter) 1956
GREGORY, W. K., Amer. Mus. of Nat. Hist., 77th St. & Central Park W., New York 24, New York ..... (Charter) 1954
*HOWELL, A. B., Alna, Maine ..... (Charter) 1951
*JACKSON, H. H. T., U.S. National Museum, Washington 25, D.C. ..... (Charter) 1952
*SHADLE, ALBERT R., 143 University Ave., Buffalo 14, New York 1956
TAYLOR, WALTER P., Dept. of Zool., So. Ill. Univ., Carbondale, Illinois ..... (Charter) 1954

Emeritus Members

ALDOUS, CLARENCE M., 4030 South 3075E, Salt Lake City, Utah 1931
CHURCH, MORTON L., 1628 Queens Road West, Charlotte, North Carolina ..... Charter
EDGE, MRS. CHARLES N., 1215 Fifth Ave., New York, New York 1930
HOLT, ERNEST G., c/o Miss Olivia Holt, 713 Monroe St., Montgomery 5, Ala. ..... Charter
HOSLEY, NEIL W., Box 694, Carbondale, Illinois 1933
HOWARD, JOHN K., Key Biscayne Hotel, 300 Ocean Dr., Key Biscayne, Miami 49, Florida 1928
LANE, H. H., 1241 West Empire St., Freeport, Illinois ..... Charter

Life Members and Annual Members

ABEGGLEN, CARL E., Fish & Wildlife Serv., Sand Point Naval Air Sta., Seattle 15, Washington 1957
ADAMS, ARTHUR K., c/o ORBS USFWS, Rm. 117, Bldg. 40, Denver Federal Center, Denver 2, Colorado 1948
ADAMS, ARTHUR W., 305 5th St. E., Rugby, North Dakota 1957
ADAMS, LOWELL, Calif. Forest & Range Exp. Sta., Susanville, California 1938
ADAMS, WILLIAM H., JR., Wildlife Res. Unit, Wildlife Bldg., Auburn, Alabama 1956
AGACINO, E. MORALES, Museo Nacional de Ciencias Nat., Hipodromo, Madrid, Spain 1933
AGATHON, OSHIN, 16 Pryor Lane, Larchmont, New York 1955
ALBRIGHT, RAY K., Rt. 1, Box 277, Dayton, Oregon 1952
*ALCORN, J. R., Univ. of Kansas, Mus. of Nat. Hist., Lawrence, Kansas 1939
ALDERSON, LOUIS E., 3404 Lynnfield, Fort Worth, Texas 1947
ALDOUS, SHALER E., Fed. Aid Div., U.S. Fish & Wildlife Service, Wash. 25, D.C. 1927
ALDRICH, JOHN W., 21 W. Spring St., Alexandria, Virginia 1951
ALEXANDER, MAURICE M., Dept. of Forest Zool., N.Y. State College of Forestry, Syracuse 10, New York 1947
ALLAN, PHILIP F., 251 Culver Rd., Rt. 5, Ithaca, New York 1931
ALLEN, DURWARD L., Dept. of Forestry & Cons., Purdue Univ., Lafayette, Indiana 1938
ALLEN, E. ROSS, Silver Springs, Florida 1948
ALLIN, A. E., Provincial Lab., Ft. William, Ontario, Canada 1942

ALTMANN, MARGARET, Kenyon College, Gambier, Ohio 1950
ALVAREZ-S, TICUL, Calle 27, No. 71, Mexico 18, D. F., Mexico 1958
AMADON, DEAN, Amer. Mus. of Nat. Hist., Central Park W. at 79th St., New York 24, New York 1938
AMES, WALTER E., 223 Fairmont Ave., New Castle, Pennsylvania 1950
ANDERSEN, JOHANNES M., Vildtbiologisk Station, Kalo pr Ronde, Denmark 1953
ANDERSEN, MARTHA SYLVIA, 916 Belleforte, Oak Park, Illinois 1958
ANDERSON, AAGE BERNARD, JR., 212 Coolidge St., Silverton, Oregon 1958
ANDERSON, ALLEN E., Coop. Wildlife Res. Unit, Colo. State Univ., Ft. Collins, Colo. 1953
ANDERSON, JOHN M., Winous Point Shooting Club, Port Clinton, Ohio 1939
ANDERSON, MILTON P., USFWS, 3 Pleasant St., Concord, New Hampshire 1952
ANDERSON, STEVEN C., 4465 9th St., Riverside, California 1952
*ANDERSON, SYD, Mus. of Nat. Hist., Univ. of Kansas, Lawrence, Kansas 1952
ANDRIS, SOPHIE, Chicago Nat. Hist. Mus., Roosevelt Rd. & Lake Shore Dr., Chicago 5, Illinois 1956
ARATA, ANDREW A., Biology Dept., Univ. of Florida, Gainesville, Florida 1956
*ARCHBOLD, RICHARD, Archbold Biol. Sta., Lake Placid, Florida, Rt. 1, Box 173 1929
ARCHIBALD, WILLIAM S., Box 531, Evans, Colorado 1957
ARNOLD, DAVID A., 502 S. 1st Ave., Escanaba, Michigan 1949
ATZ, JAMES W., New York Aquarium, Boardwalk at W. 8th St., Brooklyn 24, N.Y. 1936
AXLER, MITCHEL, 2 Old Lyme Road, Scarsdale, New York 1957
AXTELL, HAROLD H., Buffalo Mus. of Sci., Buffalo 11, New York 1945

BADER, ROBERT S., Dept. of Zool., Univ. of Ill., Urbana, Illinois 1959
BAILEY, ALFRED M., Colo. Mus. of Nat. Hist., Denver, Colorado ..... Charter
BAILEY, BERNARD, 146 E. 6th Ave., Escondido, California ..... Charter
*BAILEY, J. W., 27 Willway Rd., Richmond 21, Virginia 1927
BAKER, BERTRAM D., 802 F St., Salida, Colorado 1949
BAKER, JOHN H., 1165 5th Ave., New York, New York 1941
BAKER, ROLLIN H., The Museum, Mich. State Univ., East Lansing, Michigan 1938
BAKKEN, ARNOLD, Wisc. State College, Eau Claire, Wisconsin 1949
BALDWIN, WILLIAM P., JR., 123 Newington Rd., Summerville, So. Carolina 1939
BALL, KATHLEEN, 11719 133rd St., Edmonton, Alberta, Canada 1948
BALSER, DONALD S., 3658 Fairlane, White Bear Lake 10, Minnesota 1958
BAMPTON, THEODORE B., B F D Main St., Bethlehem, Connecticut 1952
BANASIAK, CHESTER F., Mounted Route A, Bangor, Maine 1951
BANFIELD, A. W. FRANK, National Mus. of Canada, Ottawa, Ontario, Canada 1938
*BANNON, HENRY, First National Bank Building, Portsmith, Ohio 1922
BARBEHENN, KILE R., Bldg. 10, 2n-310, Nat. Inst. of Health, Bethesda 14, Maryland 1951
BARBER, HAROLD L., West Liberty, Kentucky 1950
BARBOUR, ROGER W., Dept. of Zool., Univ. of Kentucky, Lexington 29, Kentucky 1941
BARBUSH, RAYMOND J., 139 W. 11th Ave., Columbus 1, Ohio 1959
BARD, FRED G., Dir. Sask. Mus. of Nat. Hist., Albert & College, Regina, Saskatchewan, Canada 1948
*BARKALOW, FRED S., JR., Box 5215, State College Station, Raleigh, N. Carolina 1934
BARKER, JESSE E., Box 5661, Roswell, New Mexico 1953
BARLOW, JON CHARLES, Dept. of Zool., Univ. of Kansas, Lawrence, Kansas 1959
BARNES, CLAUDE T., 359 10th Ave., Salt Lake City, Utah ..... Charter
BARRETT, CHARLES H. M., 1339 Valley Place SE, Washington 20, D.C. ..... Charter
BARRINGTON, B. A., Prof. of Biology, King College, Bristol, Tennessee 1940
BARTHOLOMEW, GEORGE A., JR., Dept. of Zool., Univ. of Cal. at Los Angeles, Los Angeles 24, California 1942
BARTLETT, CHARLES O., Box 180, Sackville, New Brunswick, Canada 1953

BARTO, ELIZABETH, Lab. of Vert. Biol., Univ. of Mich., Ann Arbor, Michigan 1938
BARTSCH, PAUL, Lebanon, Lorton, Virginia 1921
BASEY, HAROLD E., Box 419, Orosi, California 1955
BASSETT, NEIL R., Shiloh Natl. Military Park, Pittsburg Landing, Tennessee 1948
BATES, MARSTON, Dept. of Zool., Univ. of Mich., Ann Arbor, Mich. 1944
BATSON, JACKIE, Walker Junior College, Jasper, Alabama 1956
BATTS, H. LEWIS, JR., Kalamazoo College, Biol. Dept., Kalamazoo, Michigan 1947
BAUER, KURT M., Mus. A. Koenig, Koblenzerstrasse 150–164, Bonn, Germany 1958
BAUMANN, REV. SEVERIN, O F M, St. Anthony's Sem. High School, Santa Barbara, Calif. 1955
*BAUMGARTNER, LUTHER, Gen. Del. Croton Falls, New York 1937
BAXTER, WILLIAM JR., Rt. 2, Middletown, Delaware 1942
BAYLY, BOB, 1825 S W 16th St., Portland 1, Oregon 1956
BEAN, ROBERT, Chicago Zoological Park, Brookfield, Illinois 1946
BEATTIE, JACK D., 413 E. Mansion, Jackson, Michigan 1955
BEATTY, JOSEPH A., 434 Wayen Ave., Chambersburg, Pennsylvania 1956
*BEAUDETTE, PALMER T., Box 228, RFD 1, Solvang, California 1954
BECHSTEIN, FELICIA C., 1039 Lakemont Drive, Pittsburgh 16, Pennsylvania 1957
BECK, ALBERT J., 520 Oak Ave., San Bruno, California 1956
BECK, WILLIAM HARVEY, Biol. Dept., Univ. of Saskatchewan, Saskatoon, Sask., Canada 1958
BEE, JAMES W., 1820 Alabama, Lawrence, Kansas 1956
BEEMAN, ROBERT DAVID, Life Sci. Dept., Box 341, Mt. San Antonio College, Pomona, California 1959
BEER, JAMES R., Div. of Ent. & Eco. Zool., Univ. of Minn., St. Paul 1, Minn. 1940
BEHLE, WILLIAM H., Dept. of Biology, Univ. of Utah, Salt Lake City 12, Utah 1936
BEIDLEMAN, RICHARD G., Zool. Dept., Colo. College, Colorado Springs, Colo. 1948
BELL, RONDAL E., 419½ Princeton SE, Albuquerque, New Mexico 1958
BELLROSE, FRANK C., JR., Illinois Nat. Hist. Survey, Havana, Illinois 1941
BELSTAD, WALTER C., 605 W. Garfield St., Seattle 99, Washington 1949
BENDELL, J. F., Dept. of Zool., Univ. of British Columbia, Vancouver 8, Canada 1958
BENDT, ROBERT H., Grand Teton National Park, Moose, Wyoming 1956
BENEDICT, FRANCES, Life Sci. Div., Fresno State College, Fresno 26, Calif. 1952
BENSON, SETH B., Mus. of Vert. Zool., Berkeley 4, Calif. 1928
BENTON, ALLEN H., N.Y. State College for Teachers, Albany, New York 1950
BERG, ELIHU D., 1172 Ponderosa Dr., Billings, Montana 1950
BERG, WILLIAM NORMAN, 540 East 19th St., Lawrence, Kansas 1958
BERGERUD, TOM, Dept. of Mines & Resources, St. Johns, Newfoundland, Canada 1957
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FOLK, G. EDGAR, JR., Dept. of Physiology, State Univ. of Iowa, Iowa City, Iowa 1945
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FOX, WADE, JR., Dept. Anat. LSU Med. School, 1542 Tulane Ave., New Orleans 12, La. 1946
FRADE, FERNANDO, Cent. de Zool., Junta de Invest Coloniais, Rua de Junquaira 14, Lisboa, Portugal 1947
FRARY, LADD G., 1016 Cielo Azul, Santa Fe, New Mexico 1951
*FRASER, FRANCIS C., Brit. Mus. of Nat. Hist., Cromwell Rd., London SW 7, England 1948
FREE, STUART L., New York State Cons. Dept., Wildlife Res. Lab., Delmar, N.Y. 1958
FREIBURG, RICHARD E., MacMurray College, Jacksonville, Illinois 1957
FRENZEL, L. D., JR., Dept. of Biol., Macalester College, St. Paul 5, Minnesota 1955
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FRIEDERS, REV. FABIAN O S B, Biol. Dept., Saint Meinrad Archabbey, Saint Meinrad, Indiana 1950
FRILEY, CHARLES E., JR., Swan Creek Wildlife Experiment Station, Allegan, Mich. 1939
FRITZ, ARNOLD W., Greenville College, Greenville, Illinois 1955
FRUM, W. GENE, 311 Holswade Dr., Huntington, West Virginia 1941
FRY, JACK F., Dept. of Life Sci., Santa Monica City College, Santa Monica, Calif. 1955
FRYE, O. E., JR., Game & Fresh Water Fish Comm., Tallahassee, Florida 1946
FULLER, WILLIAM A., Canadian Wildlife Serv., Box 2357, Whitehorse, Yukon Terr., Canada 1948

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GARDNER, KENNETH V., 258 Philadelphia St., Indiana, Pennsylvania 1954
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GAZIN, C. LEWIS, U.S. National Museum, Washington 25, D.C. 1931
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GEORGE, IRA D., Dept. Zool., La. State Univ., Baton Rouge, Louisiana 1939
GEORGE, JOHN L., Patuxent Research Refuge, Laurel, Maryland 1951
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GETZ, LOWELL L., Dept. of Zool., Univ. of Michigan, Ann Arbor, Michigan 1956
GIBBS, ROBERT H., JR., Dept. of Biol., Boston Univ., Boston 15, Mass. 1951
GIBSON, FLOYD W., 501 W. Aluminum, Butte, Montana 1957
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GILLESPIE, DAVID M., 751 Valerie Lane, Columbus 13, Ohio 1955
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GLENNY, FRED H., F A Z, Youngstown Univ., Youngstown 2, Ohio 1946
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GODFREY, GILLIAN, Mammal Rm., Brit. Mus. Nat. Hist., Cromwell Rd., London SW 7, England 1958
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GOLDEN, JACK S., 121 E. Scott Ave., Olney, Illinois 1957
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GREEN, HENRY B., Gracemere, Tarrytown, New York 1945
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GUILDAY, JOHN E., Carnegie Museum, Pittsburgh 13, Pennsylvania 1946
GUNDERSON, HARVEY L., Mus. of Nat. Hist., Univ. of Minn., Minneapolis 14, Minn. 1943
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GUNTHER, W. C., Dept. of Biol., Valparaiso Univ., Valparaiso, Indiana 1958
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HALLORAN, ARTHUR F., Wichita Refuge, Cache, Oklahoma 1934
HALTENORTH, THEODOR, Zool. Sammlung des Bayer Sauge, Menzingerstrasse 67, Munchen 38, Germany 1950

HALVORSON, CURTIS H., U S F W S Missoula Res. Ctr., Fed. Bldg., Missoula, Montana 1957
HAMERSTROM, MRS. FRANCES, Plainfield, Wisconsin 1938
*HAMILTON, WILLIAM J., JR., Fernow Hall, Cornell Univ., Ithaca, New York 1924
HAMILTON, WILLIAM J., III, Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, Calif. 1952
HAMMEL, HAROLD T., Dept. of Physiology, Univ. of Pa. Med. Sch., Philadelphia, Pa. 1951
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HANSEN, EDWARD L., Fish & Game Dept., Oregon State College, Corvallis, Oregon 1952
*HANSEN, RICHARD M., Agri. Exp. Sta., Colo. State Univ., Fort Collins, Colo. 1950
HANZAK, JAN, National Mus., Prague 2 - 1700, Czechoslovakia 1957
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HAYNE, DON W., Inst. for Fisheries Res., Univ. Mus. Annex, Ann Arbor, Mich. 1933
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HAYS, RODNEY M., JR., Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio 1952
HAYWARD, BRUCE J., Zool. Dept., Univ. of Arizona, Tucson, Arizona 1951
HAYWARD, C. LYNN, Dept. of Zoology, Brigham Young Univ., Provo, Utah 1938
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HECHT, MAX K., Dept. of Biol., Queens College, Flushing 67, New York 1943
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HEMPHILL, DONALD V., Pacific Union College, Angwin, California 1948
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HENDRICKSON, GEORGE O., Dept. of Zool. & Ento., Iowa State College, Ames, Iowa 1937
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HENNING, WILLARD L., Bryan Univ., Dayton, Tennessee 1950
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HEPBURN, ROBIN L., RR 2, Maple, Ontario, Canada 1955
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HEYMANS, K. J., Wilgenstraat 118, Haarlem, The Netherlands 1956
*HIBBARD, CLAUDE W., Mus. of Paleontology, Univ. Mus. Bldg., Ann Arbor, Mich. 1932
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HITCHCOCK, H. B., Dept. of Biology, Middlebury College, Middlebury, Vt. 1940
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HOFFMAN, RUSSELL R., Box 351, Delafield, Wisconsin 1954
HOFFMEISTER, DONALD F., Mus. of Nat. Hist., Univ. of Illinois, Urbana, Ill. 1938
HOGG, VICTOR H., The Mus., Mich. State Univ., East Lansing, Michigan 1955
HOLDENRIED, ROBERT, USPHS, Liaison Office, Public Health Serv., Fort Detrick, Maryland 1940
HOLLING, CRAWFORD S., Forest Insect. Lab., Sault Ste. Marie, Ontario, Canada 1952
HOLMAN, JOHN P., Fairfield, Connecticut 1921
HOLMES, JOHN CARL, Dept. of Biology, The Rice Institute, Houston 1, Texas 1957
HOLSWORTH, WILLIAM NORTON, Ft. Camp, Univ. of British Columbia, Vancouver, B C, Canada 1958
HONEGGER, RENE E., c/o Zoological Garden, 34th & Girard Ave., Philadelphia 4, Pa. 1959
HOOGSTRAAL, H., NAMRU3, U.S. Embassy Cairo c/o Navy, Pouch Sect. Navy Dept., Washington 25, D.C. 1947
HOOIJER, D. A., Rijksmuseum van Nat. Historie, Leiden, The Netherlands 1951
HOOPER, EMMET T., Mus. of Zool., Univ. of Mich., Ann Arbor, Mich. 1934
HOOPER, WALTER M., 7704 District Hts. Pkwy., Apt. 9, Washington 28, D.C. 1953
HOOPES, DAVID T., Dept. of Zool. & Ento., Iowa State College, Ames, Iowa 1958
HOPSON, JAMES ALLEN, 205 Walker Mus., Univ. of Chicago, Chicago 37, Ill. 1958
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HOSLETT, SHERMAN A., Luther College, Decorah, Iowa 1932
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*JONES, J. KNOX JR., Mus. of Nat. Hist., Univ. of Kansas, Lawrence, Kansas 1947
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*KELSON, KEITH R., National Science Foundation, Washington 25, D.C. 1941
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*KENYON, KARL W., U.S.F.W.S., Sand Point N.A.S., Seattle 15, Washington 1948

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MANVILLE, RICHARD H., Fish & Wildlife Service, U.S. National Museum, Washington 25, D.C. 1939
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PARK, EDWIN CLYDE, Box 887, Bend, Oregon 1959
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PARKER, WARREN T., 306 Chamberlain St., Raleigh, North Carolina 1958
PARMALEE, PAUL W., Ill. State Mus., Springfield, Illinois 1952
PARROT, HADLEY, 72 Somerset St., Bangor, Maine 1946
PARSONS, WILLIAM G., Box 386, Ely, Nevada 1957
PASSMORE, RICHARD C., 373 Bell St., Pembroke, Ontario, Canada 1953
PATTERSON, BRYAN, Mus. of Comp. Zool., Cambridge 38, Massachusetts 1957
PEARSON, ALLEN M., P O Box 1031, Alabama Polytechnic Institute, Auburn, Alabama 1938
PEARSON, ERWIN WHITTIER, Coop. Wildlife Res., Southern Ill. Univ., Carbondale, Ill. 1959
PEARSON, OLIVER P., Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, California 1937
PEARSON, PAUL G., Zool. Dept., Rutgers Univ., New Brunswick, New Jersey 1948
PEEK, JAMES MERRELL, 1206 9th Ave., Helena, Montana 1959
PELCH, WILLIAM E., 5016 W. 25th Place, Cicero 50, Illinois 1956
PERKINS, R. MARLIN, Lincoln Park Zoo., Chicago 14, Illinois 1959
PERROTTA, CARMIE ANN, 194 Division St., Kingston, Ontario, Canada 1955
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PETERS, STUART S., Wildlife Division, Dept. of Mines and Resources, St. Johns, Newfoundland, Canada 1955
PETERSON, BERKELEY ROY, 300 Coffey Hall, Univ. of Minn., St. Paul Campus, St. Paul 1, Minnesota 1958
PETERSON, LIVEN A., JR., 2501 West Division, Grand Island, Nebraska 1942
PETERSON, RANDOLPH L., Div. of Mammalogy, Royal Ontario Mus., Toronto, Ontario, Canada 1940
PETRIDES, GEORGE A., Dept. of Fisheries & Wildlife, Mich. State Univ., East Lansing, Michigan 1944
PFEIFFER, EGBERT W., Dept. of Anatomy, Univ. of North Dakota, Grand Forks, North Dakota 1951
PFENDLER, PETER G., Rt. 9, Lafayette, Indiana 1958
PFLUEGER, AL, Box 1328, North Miami, Florida 1939
PHILLIPS, RICHARD S., 834 Liberty, Findlay, Ohio 1955
PHIPPS, THOMAS T., Box 1141, Fort Worth, Texas 1957
PICTON, HAROLD D., Dept. of Zool. and Ento., Montana State College, Bozeman, Montana 1954
PIERCE, ROBERT A., 1256 17th St., West Des Moines, Iowa 1952
PIKE, GORDON C., Pacific Biol. Sta., Fisheries Res. Bd. of Canada, Nanaimo, B C, Canada 1950
PILLSBURY, CHARLES W., 690 Rand Ave., Oakland, California 1953
PIMLOTT, D. H., Dept. of Lands and Forests, RR 1, Maple, Ontario, Canada 1950
PIRLOT, PAUL LEON, Dept. de Biol., Univ. de Montreal, C P 6128, Montreal, P Q, Canada 1955
PITELKA, FRANK A., Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, California 1954
POHLE, HERMANN, Bamberger Stras 32, Berlin W 30, Germany 1928
POILEY, SAMUEL M., Nat. Inst. of Health, Rockville Pike B, Bethesda, Maryland 1947
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PRAHLAD, KADABA V., Dept. of Zool., Univ. of Missouri, Columbia, Missouri 1956
PRASIL, RICHARD G., Lassen Volcanic Natl. Park, Mineral, California 1953
PRATT, HAROLD P., Box 160, Soil Cons. Service, Montrose, Colorado 1941
PREBLE, NORMAN A., Dept. Biol., N E Univ., 360 Huntington Ave., Boston 15, Mass. 1935
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PRIDDY, RALPH B., Carthage College, Carthage, Illinois 1941
PROGULSKE, DONALD R., Ento.-Zool. Dept., So. Dakota State College, Brookings, S.D. 1951
PROVO, MARVIN M., Young Harris College, Young Harris, Georgia 1952
PROVOST, ERNEST E., Vivarium Bldg., Wright & Healy Sts., Champaign, Illinois 1949
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PRYCHODKO, WILLIAM, Detroit Inst. of Cancer Res., 4811 John R St., Detroit 1, Mich. 1950

QUAY, WILBUR B., Div. of Zool., Univ. of California, Berkeley 4, California 1946
QUIMBY, DON, Dept. Zool. & Ento., Montana State College, Bozeman, Montana 1941

RABB, GEORGE BERNARD, Chicago Zool. Park, Brookfield, Illinois 1957
RABINOWITCH, VICTOR, 1021 W. Church St., Champaign, Illinois 1956
RABOR, DIOSCORO S., Silliman Univ., Dumaguete, Negros Orientale, Philippine Islands 1951
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RAGEOT, ROGER, Norfolk Museum, Norfolk, Virginia 1951
RAINEY, DENNIS, 3708 Nipomo, Long Beach 8, California 1951
RAITT, RALPH J., JR., Dept. of Biol., New Mexico State Univ., State College, New Mexico 1955
RAMSAY, MAYNARD J., 29 Tillman St., Staten Island 14, New York 1947
RAMSEY, RALPH L., 679 Amsterdam Ave. N E, Atlanta 6, Georgia 1953
RANCK, GARY L., Dept. of Zool., Univ. of Utah, Salt Lake City, Utah 1959
RAND, A. L., Chicago Nat. Hist. Mus., Roosevelt Rd. & Lake Shore Drive, Chicago 5, Illinois 1933
RANKIN, JESSIE J., Univ. Coll. of Rhodesia & Nyasaland, Salisbury, S. Rhodesia, Africa 1954
RASMUSSEN, D. I., Dept. of Zool., Univ. of Mich., Ann Arbor, Michigan 1956
RASMUSSEN, D. I., U.S. Forest Service, Forest Service Bldg., Ogden, Utah 1936
RAUGHT, RICHARD W., Cottage San Rd., Silver City, New Mexico 1955
RAUN, GERALD G., Dept. of Zool., Univ. of Texas, Austin, Texas 1958
RAUSCH, ROBERT A., Box 6123, Anchorage, Alaska 1958
RAUSCH, ROBERT L., U.S. Public Health Service, Box 960, Anchorage, Alaska 1945
RAWLINGS, WILLIAM R., Rt. 2, Box S-26, Durango, Colorado 1957
RAWSON, KENNETH S., Dept. of Zool., Birge Hall, Univ. of Wisc., Madison 6, Wisc. 1951
RAY, CLAYTON E., Mus. Comp. Zool., Cambridge 38, Massachusetts 1956
RAY, EDWARD M., Roscommon, Michigan 1954
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REED, EDWARD B., Dept. of Biology, Univ. of Saskatchewan, Saskatoon, Sask., Canada 1954
REED, LOWELL J., Shelburne, New Hampshire 1956
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REEVES, HENRY M., Box 407, Aberdeen, South Dakota 1953

REHN, JAMES A. G., Academy of Nat. Sci., Logan Square, Philadelphia 3, Pa. ..... Charter
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RENSEL, JACK A., 1267 Harrop St., Ogden, Utah 1955
RETT, EGMONT Z., Santa Barbara Mus. of Nat. Hist., Santa Barbara, Calif. 1924
REUTHER, RONALD T., 974 Apt. C, Dolores Dr., Lafayette, California 1958
REYNOLDS, HAROLD C., Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, Calif. 1944
REYNOLDS, HUDSON G., Rm. 107 Agric. Bldg., Ariz. State Univ., Tempe, Arizona 1950
RICE, DALE W., U S F W S Marine Mamm. Res. Sect., Sand Point N A S Bldg. 192, Seattle 15, Washington 1949
RICHARDS, STEPHEN H., Dept. of Vet. Sci., N. Dakota Agric. Coll., Fargo, No. Dakota 1957
RICHARDSON, ROBERT C., Box 751, Tarleton Station, Stephenville, Texas 1957
RICHARDSON, WILLIAM B., 907 E. Mill St., Porterville, California 1933
RICHTER, CURT P., Psychological Lab., Johns Hopkins Hospital, Baltimore, Md. 1924
RIDGEWAY, BILL T., Dept. of Biol., Southwestern College, Winfield, Kansas 1957
RIEDESEL, MARVIN L., Dept. of Occupational Health, Univ. of Pittsburgh, Pittsburgh 13, Pennsylvania 1954
RIESE, WALTHER, Medical College of Virginia, Richmond, Virginia 1948
RINEY, THANE A., c/o National Mus., Box 240, Bulawayo, Southern Rhodesia 1941
RINKER, GEORGE C., Dept. of Anatomy, Univ. of Mich., Ann Arbor, Michigan 1941
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RITCEY, RALPH W., R R 1, Clearwater Sta., British Columbia, Canada 1955
ROBEL, BOB, Coop. Wildlife Res. Unit, Utah State Univ., Logan, Utah 1957
ROBERTS, DON RAOUL, Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, Calif. 1957
ROBERTS, HARVEY A., 4510 Beaufort Farms Rd., Harrisburg, Pennsylvania 1949
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ROCHE, EDWARD TOWNE, c/o Dept. of Life Science, Compton College, Compton, Calif. 1952
ROCKCASTLE, VERNE N., 102 Sunset Dr., Ithaca, New York 1955
*RODECK, HUGO G., Univ. of Colo. Mus., Boulder, Colorado 1939
ROECKER, ROBERT M., N.Y. Cons. Dept., 2130 Scottsville Rd., Scottsville, N.Y. 1946
ROEST, ARYAN I., Dept. of Biology, Calif. Poly. State College, San Luis Obispo, Calif. 1949
ROGERS, ALBERT C., Denver Mus. of Nat. Hist., Denver, Colorado ..... Charter
*ROGERS, CHARLES H., Mus. of Zool., Princeton, New Jersey ..... Charter
ROGERS, JOHN WEST, 23 Manor Drive, Hudson, Ohio 1959
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RONEY, ERNEST E., Jr., 27 Burchstead Pl., Lynn, Massachusetts 1954
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RUMSEY, WILLIAM L., 1336 North Ave., Elizabeth, New Jersey 1953
RUSSELL, LORIS SHANO, National Mus. of Canada, Ottawa, Ontario, Canada 1929
*RUSSELL, RICHARD W., Naturalist Section, Gt. Smoky Mts. Nat. Park, Gatlinburg, Tennessee 1955
RUSSELL, ROBERT J., JR., Dept. of Biol., Univ. of Kansas City, Kansas City, Mo. 1949
RUSSELL, WARD C., Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, California 1930
RYAN, RICHARD A., 10 College Ave., Geneva, New York 1950
RYCKMAN, RAYMOND E., Ento. Section, Sch. of Tropical Med., Loma Linda, Calif. 1951
RYDER, RONALD A., College of Forestry, Colo. State Univ., Fort Collins, Colo. 1949
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RYSER, FRED A., JR., Biol. Dept., Univ. of Nevada, Reno, Nevada 1950

SAGAR, ROBERT G., 365 Carpenter Road, Gahanna, Ohio 1955
SALMAN, D. H., 2765 St. Catherine Rd., Montreal 26, Quebec, Canada 1953
SANBORN, COLIN C., Marcella, Arkansas 1924
SANDERSON, GLEN C., State Nat. Hist. Surv., Urbana, Illinois 1947
SANDILANDS, KEITH M., Box 281, Ontario Vet. Coll., Guelph, Ontario, Canada 1956
SANDS, JAMES L., 2917 Franciscan St. NE, Albuquerque, New Mexico 1951
SANFORD, PHIL, 5733 Richardson Rd., Rt. 3, Howell, Michigan 1954
SARGEANT, ALAN B., 3089 No. Chatworth, St. Paul 13, Minnesota 1958
SATHER, J. HENRY, Dept. of Biol. Sci., Western Ill. Univ., Macomb, Illinois 1951
SAUNDERS, JACK K., Steady Brook, Newfoundland, Canada 1954
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SCHARFFENBERG, R. S., Coll. of Med. Evangelists, School of Trop. & Prev. Med., Loma Linda, California 1949
SCHEFFER, VICTOR B., Sand Point Naval Air Sta., Seattle 15, Washington 1938
SCHEIN, MARTIN W., Dept. of Poultry Husbandry, Penn. State Univ., University Park, Pennsylvania 1950
SCHEMNITZ, SANFORD D., Minn. Dept. of Cons., Madelia Game Res. Center, Madelia, Minnesota 1958
SCHERER, LLOYD E., JR., Box 34, Lutsen, Minnesota 1940
SCHEVILL, WILLIAM, Woods Hole Oceanographic Inst., Woods Hole, Massachusetts 1953
SCHILLER, EVERETT L., Johns Hopkins Sch. of Publ. Health, 615 N. Wolfe St., Baltimore 5, Maryland 1950
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*SCHMIDT, OLIVER C., JR., 2316 Clover Lane, Northfield, Illinois 1957
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SCHORGER, A. W., 168 North Prospect Ave., Madison, Wisconsin 1924
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SCHRECK, CARL E., Hanover Rd., Yorktown Heights, New York 1955
SCHULTZ, BERTRAND, Univ. Nebr. State Mus., Lincoln, Nebraska 1934
SCHWAB, ROBERT G., 2109-A Hoyt Ave. West, St. Paul 8, Minnesota 1957

SCHWAGER, HAROLD GENE, 385 Morris St., Albany, New York 1956
SCHWARTZ, ALBERT, Dept. of Biology, Albright College, Reading, Pennsylvania 1948
SCHWARTZ, CHARLES W., 131 Forest Hill, Jefferson City, Missouri 1950
SCHWARZ, MAX D., 625 Tuxedo Blvd., Webster Groves 19, Missouri 1934
SCOTT, LEONARD M., 6537 S E 83rd St., Portland 66, Oregon 1955
SCOTT, ROBERT F., USFWS, Box 6123, Anchorage, Alaska 1949
*SCOTT, THOMAS G., State Nat. Hist. Surv., Urbana, Illinois 1937
SCOTT, WALTER J., 140 Woodland Dr., Thomasville, Georgia 1933
SEABLOOM, ROBERT W., 300 Coffey Hall, Univ. of Minn., St. Paul 1, Minn. 1956
SEALANDER, JOHN A., Dept. of Zoology, Univ. of Arkansas, Fayetteville, Arkansas 1941
SEARS, HOWARD S., Box 1867, Juneau, Alaska 1953
SEFTON, J. W., JR., Nat. Hist. Museum., Balboa Park, San Diego 1, California 1925
SEIDEL, DONALD R., 110 N. Main St., Cortland, New York 1954
SENSENIG, E. CARL, Medical College of Alabama, Birmingham 5, Alabama 1944
SERGEANT, DAVID E., Fish. Res. Bd. of Canada, Arctic Unit, 505 Pine Ave., W., Montreal, P. Q., Canada 1958
SETZER, HENRY W., U.S. National Museum, Washington 25, D.C. 1945
SEVERAID, J. HAROLD, Dept. of Life Sciences, Sacramento State College, Sacramento, California 1940
*SEVERINGHAUS, CHARLES W., R D 2, Voorheesville, New York 1947
SEVERSON, DANIEL J., 42 W. Main St., Cambridge, New York 1958
SHADOWEN, HERBERT E., Walnut Ave., Rt. 2, Ruston, Louisiana 1956
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SHARMA, D. R., Zoology Dept., Science College, Raipur, (M. P.), India 1956
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SHELDON, WILLIAM G., Wildlife Dept., Univ. of Massachusetts, Amherst, Massachusetts 1933
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SHEPPE, WALTER A., JR., Vassar College, Poughkeepsie, New York 1951
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SHEWFELT, DAVE B., c/o Edwin Shewfelt, 40 Tierney Rd., Rt. 4, Bay City, Mich. 1958
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SHIPPEE, E. ALLEN, 20 S. 2nd St., E., Spanish Fork, Utah 1953
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Simpson, George Gaylord, Amer. Mus. of Nat. Hist., Central Park W. at 79th St., New York 24, New York 1928
Sisk, Morgan E., 823 W. McElroy Ave., Stillwater, Oklahoma 1959
Sivertsen, Erling, Videnskabernes Selskabs Bibl., c/o F. Bruns Bokhandel, Trondheim, Norway 1948
Skillen, Donald R., 419 Garfield Ave., South Pasadena, California 1933
Skinner, Morris F., Amer. Mus. of Nat. Hist., 77th St. & Central Park W., New York 24, New York 1941
Skoog, Ronald Oliver, Box 4-087, Anchorage, Alaska 1959
Smalley, Alfred E., Dept. of Zool., Univ. of Kentucky, Lexington, Kentucky 1951
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Solman, Victor E. F., Dept. N. Affairs & Nat. Res., Canadian Wildlife Service, Ottawa, Ontario, Canada 1950
Soloff, Bernard L., Biol. Dept., The Rice Institute, Houston 1, Texas 1958
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Spencer, David L., Kenai, Alaska 1951
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Sperry, Arthur B., 333 Denison, Manhattan, Kansas 1923
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Stager, Kenneth, Los Angeles Mus., Exposition Park, Los Angeles 7, Calif. 1936
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Stallcup, William B., Jr., Biol. Dept., Southern Methodist Univ., Dallas, Texas 1948
Stanley, Walter C., Hamilton Station, R B Jackson Memorial Lab., Bar Harbor, Maine 1958
Starck, D., Anat. Institut L. Rehnstrasse, Frankfurt am Main, Germany 1956

*STARRETT, ANDREW, Dept. of Biol., Univ. of Southern Calif., Los Angeles 7, Calif. 1951
STEBLER, ADOLPH M., Okla. Coop. Wildlife Res. Unit, Oklahoma State Univ., Stillwater, Oklahoma 1933
STEELE, CHARLES N., JR., 2324 S. Bonnie Brook Lane, Waukegan, Illinois 1947
STEGEMAN, LE ROY C., Dept. of Forest Zool., New York State Coll. of Forestry, Syracuse 10, New York 1929
STEIN, DR. GEORGE, Zoologisches Mus., Invalidenstrasse 43, Berlin N4, Germany 1952
STENTON, JAMES E., Box 29, Banff, Alberta, Canada 1945
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STIEBRING, WARREN R., Institute of Microbiology, Rutgers Univ., New Brunswick, New Jersey 1947
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STIRTON, R. A., Mus. of Palentology, Berkeley 4, California 1923
STIVEN, ALAN E., 2321 Agronomy Place, Univ. of British Columbia, Vancouver B C, Canada 1956
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STORER, ROBERT WINTHROP, Mus. of Zool., Univ. of Mich., Ann Arbor, Mich. 1937
*STORER, TRACY I., Dept. of Zool., Univ. of Calif., Davis, California .... Charter
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SWANSON, GUSTAV, Fernow Hall, Cornell Univ., Ithaca, New York 1935
SWENSON, LOWELL E., 545 Concord Ave., Boulder, Colorado 1950
SWIFT, LLOYD W., Forest Service, U.S. Dept. of Agric., Washington 25, D.C. 1945
SWINDELL, DAVID E., JR., 1004 Julia St., Perry, Florida 1948
SWINDLE, PERCY F., 2808 N. 40th St., Milwaukee 10, Wisconsin 1927
SWITZENBERG, D. F., Dept. of Cons., Cusino Wildlife Exp. Sta., Shingleton, Mich. 1947
SWORD, ROBERT HAYS, Box 22, Homer, Minnesota 1958
SWYNNERTON, GERALD H., Game Dept., Box 397, Arusha, Tanganyika, E. Africa 1940

TABER, RICHARD D., Sch. of Forestry, Mont. State Univ., Missoula, Montana 1952
TAFT, JOHN E., 352 Glenellen Dr., Ventura, California 1957
TALBOT, LEE MERRIAM, 2590 Cedar St., Berkeley, California 1956
TAMSITT, J. R., Dept. of Biology, East Texas State College, Commerce, Texas 1952
TANAKA, RYO, Zool. Lab., Kochi Womens Univ., Kochi City, Shikoku, Japan 1952
TANNER, VASCO M., Brigham Young Univ., Provo, Utah ..... Charter
TAYLOR, BERYL E., Amer. Mus. of Nat. Hist., 77th St. at Central Park West, New York, New York 1958
TAYLOR, J. MARY, 64 Panoramic Way, Berkeley 4, California 1952
TEACHENOR, DIX, Box 139, Kansas City Life Ins. Co., Kansas City 41, Missouri 1920
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TENER, JOHN SIMPSON, Canadian Wildlife Serv. Nat. Pks. Br., 150 Wellington St., Ottawa, Ontario, Canada 1949
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TERRES, JOHN K., 345 E. 57th St., New York 22, New York 1935
TEST, FREDERICK H., Dept. of Zool., Univ. of Mich., Ann Arbor, Michigan 1930
TESTER, JOHN ROBERT, Mus. of Nat. Hist., Univ. of Minn., Minneapolis 14, Minn. 1958
TEVIS, LLOYD P., JR., Box 308, Rancho Mirage, California 1940
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THOMAS, ALLEN E., 3239 E. Almartin, Tucson 12, Arizona 1955
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THOMAS, WARREN D., 87 S. Westgate Ave., Columbus 4, Ohio 1957
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THOMPSON, DANIEL Q., Biol. Dept., Ripon College, Ripon, Wisconsin 1944
THOMSON, DAVID H., Dept. of Biol. Sci., Calif. Polytechnic College, San Luis Obispo, California 1948
THORINGTON, RICHARD W., JR., 2 South Dod, Princeton Univ., Princeton, New Jersey 1958
THORNE, OAKLEIGH, II, Thorne Ecological Res. Sta., 1707 Hillside Rd., Boulder, Colo. 1958
THORNTON, WILMOT A., Dept. of Biol., Sam Houston State College, Huntsville, Texas 1954
THORSON, THAD E., 10431 Parliament, Garden Grove, California 1958
THORSON, THOMAS B., Dept. of Zool., Univ. of Nebraska, Lincoln, Nebraska 1951

THRALL, RICHARD E., Hemlock Public School, Hemlock, Michigan 1957
TIEMEIER, OTTO W., Dept. of Zool., Kansas State Univ., Manhattan, Kansas 1938
TIETZ, WILLIAM J., Rt. 2, Lafayette, Indiana 1952
TINKER, ALTHA HARRIET, Lasell College, Auburndale 66, Massachusetts 1955
TOLL, W. G., RFD 3, Box 74, Amherst, Massachusetts 1956
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TOMPKINS, ROBERT, Salt Point, New York 1958
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TONG, GEORGE LAUREN, 1104 E. Peck St., Compton, California 1959
TONGIORGI, EZIO, Inst. di Anthropologia, Via S Maria n 31, Pisa, Italy 1956
*TORREY, EDWARD P. E., 122 Victory Dr., Rome, New York 1942
TOWNES, GEORGE FRANKLIN, 209 Masonic Temple, Greenville, South Carolina 1954
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TOWNSEND, JOSEPH E., 1008 S. 13th, Bozeman, Montana 1952
TRAPIDO, HAROLD, Virus Res. Center, Box 11, Poona 1, India 1941
TRAVIS, HUGH F., Dept. of Poultry Husbandry, Mich. State Univ., East Lansing, Mich. 1946
TROYER, JOHN R., Dept. of Anat., Temple Univ., 3400 N. Broad St., Philadelphia, Pa. 1956
TROYER, WILL, Fish & Wildlife Service, Kodiak, Alaska 1956
TRYON, CLARENCE A., JR., Dept. of Biol. Sci., Univ. of Pittsburgh, Pittsburgh 13, Pennsylvania 1940
TURNBULL, WILLIAM D., Chicago Nat. Hist. Mus., Roosevelt Rd. & Lake Shore Dr., Chicago 5, Illinois 1953
*TWENTE, JOHN W., JR., Dept. of Biol., Univ. of Utah, Salt Lake City, Utah 1952
TYSON, EDWIN L., Box 201, Silver Springs, Florida 1950

UHLER, FRANCIS M., Patuxent Res. Refuge, Laurel, Maryland 1926
ULMER, FREDERICK A., JR., Zool. Soc. Phila., 34th St. & Girard Ave., Philadelphia 4, Pennsylvania 1939
URBAN, EMIL K., Dept. of Zool., Univ. of Wisconsin, Madison 6, Wisconsin 1956

VAN DEN BRINK, F. H., Rapenburg 108, Leiden, Netherlands 1928
*VAN DEUSEN, HOBART M., Amer. Mus. of Nat. Hist., Central Park W. at 79th St. New York 24, New York 1946
VANDIVERT, RITA, 21 E. 10th St., New York 3, New York 1957
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VAZQUEZ, A. W., 5722 11th St. N Apt. 3, Arlington, Virginia 1955
VERME, LOUIS J., Cusino Wildlife Exp. Sta., Shingleton, Michigan 1954
VERTS, BOBBIE JOE, Box 103, Chadwick, Illinois 1956
VESEY-FITZGERALD, L. D. E. F., International Red Locust Control Station, Abercorn, Northern Rhodesia, Africa 1958
VEST, EDWIN D., 337 Denver St., Salt Lake City, Utah 1956
VIAL, JAMES L., 121 Moonstone, Manhattan Beach, California 1955
VILLA-R, BERNARDO, Instituto de Biologia UNAM, Apartado Postal No. 29817, Mexico 18, D F, Mexico 1942

VOGE, MARIETTA, Medical School, Univ. of Calif., Los Angeles, California 1944
VOHS, PAUL A., JR., Coop. Wildlife Res., Southern Illinois Univ., Carbondale, Ill. 1957
VOKE, EDWARD N., 614 North Shore Rd., Norfolk 5, Virginia 1958
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WADE, OTIS, 1400 Madrid St., Coral Gables 34, Florida 1926
WAGNER, HELMUTH O., Mus. fur Naturvolker-Handelskunde, Bremen, Germany 1948
WAKE, DAVID B., Dept. of Biology, Univ. of Southern Calif., Los Angeles 7, Calif. 1958
WALKER, ERNEST P., Apt. 404, 3016 Tilden St. N W, Washington 8, D.C. ..... Charter
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WALLNER, ALFRED, 201 Buffalo Block, Kalispell, Montana 1945
WALTHER, JOHN R., Gulf Island Natl. Wildlife Ref., Box 292, Biloxi, Mississippi 1954
WARBACH, OSCAR, Game Division, Dept. of Cons., Lansing 26, Michigan 1940
WARD, CHARLES E., 2003 S. Poplar, Casper, Wyoming 1949
WARE, GRAYDON L., Dept. of Biology, Mercer Univ., Macon, Georgia 1951
WARNER, RALPH A., Sucher, Georgia 1957
WARNER, RAYMOND LEE, North Hall, Univ. of Cal. at Davis, Davis, California 1958
WARNER, RICHARD E., Box 5425, Honolulu, Hawaii 1957
WARVEL, HAROLD E., 2811 Hastings Road, Donelson, Tennessee 1949
WASSIF, KAMAL, Dept. of Zool. Faculty of Science, Ein Shams Uni., Abbassia, Cairo, Egypt 1953
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WATERS, JOSEPH H., 24 Winter St., Whitman, Massachusetts 1954
WATSON, ARTHUR R., 4700 Forest Park Ave., Baltimore 7, Maryland 1944
WAUER, ROLAND H., Death Valley Nat. Mon., Death Valley, California 1957
WAY, IVAN M.,1231 Humboldt St., Denver 18, Colorado 1927
WEBB, ROBERT, Game Biologist Rm. 505, Nat. Res. Bldg., Edmonton, Alberta, Canada 1953
WEBSTER, DOUGLAS B., Stimson Hall, Cornell Univ., Ithaca, New York 1958
WEBSTER, H. R., Room 433, Post Office Bldg., Edmonton, Alberta, Canada 1950
WECKER, STANLEY CHARLES, Dept. of Zool., Univ. of Mich., Ann Arbor, Michigan 1958
WEEDEN, ROBERT B., Dept. of Zool., Univ. of British Col., Vancouver 8, BC, Canada 1954
*WEEMS, F. CARRINGTON, Box 512, Grand Central Sta., New York 17, New York 1930
WEIGEL, ROBERT D., Dept. of Biol., Howard College, Birmingham, Alabama 1958
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WELCH, JACK F., Bldg. 45, Fed. Center, Denver, Colorado 1949
WELCH, JOSEPH M., S W Desert Res. Sta., Portal, Arizona 1958
WELLS, PATRICK H., Dept. of Biol., Occidental College, Los Angeles 41, Calif. 1957
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WEST, LARRY J., 1926 Aurelius Rd., Holt, Michigan 1955
WESTON, HENRY GRIGGS, JR., Dept. of Biol. Science, San Jose State College, San Jose, California 1957
WETHERBEE, DAVID K., R F D, Hampton, Connecticut 1955
*WETMORE, ALEXANDER, U.S. National Museum, Washington 25, D.C. ..... Charter
WETZEL, RALPH M., Dept. of Zool., Univ. of Connecticut, Storrs, Connecticut 1947
WHARTON, CHARLES H., Box 153, Avondale Estates, Georgia 1947

WHELAN, MARY ELIZABETH, 310 Amity, Muskegon, Michigan 1955
WHEELER, WALTER H., Dept. of Geol. & Geog., Univ. of North Carolina, Chapel Hill, North Carolina 1950
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WHITMOYER, T. F., Dept. of Biol., Fort Hays Kansas State College, Hays, Kansas 1956
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WIEGERT, RICHARD G., Dept. of Zool., Mich. State Univ., East Lansing, Michigan 1957
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WILLIAMS, LAIDLAW O., R F D No. 1, Box 128, Carmel, California 1947
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WIMMER, ROBERT B., Mus. of Nat. Hist., Univ. of Kansas, Lawrence, Kansas 1958
WIMSATT, WILLIAM A., Dept. of Zool., Cornell Univ., Ithaca, New York 1941
WING, ANNE ELIZABETH SCHWARZ, Biol. Dept., Univ. of Florida, Gainesville, Fla. 1956
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YATES, RONALD W., Coop. Wildlife Res. Lab., Southern Illinois Univ., Carbondale, Illinois 1956
YEAGER, LEE E., Colorado State Univ., Fort Collins, Colorado 1937
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YERGER, RALPH W., Dept. of Biol. Sci., Florida State Univ., Tallahassee, Fla. 1948
YOAKUM, JIM, Box 781, Vale, Oregon 1956
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YOUNG, NANCY, 206 E. McPherson, Findlay, Ohio 1958
YOUNG, STANLEY P., U.S. Fish & Wildlife Service, Washington 25, D.C. 1928
YOUNGMAN, PHILLIP M., Dept. of Biol., Univ. of Tampa, Tampa 6, Florida 1952

ZAHNISER, HOWARD, 6222 - 43rd Ave., Hyattsville, Maryland 1935
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ZIEGLER, ALAN C., Mus. of Vert. Zool., Univ. of Calif., Berkeley 4, California 1958
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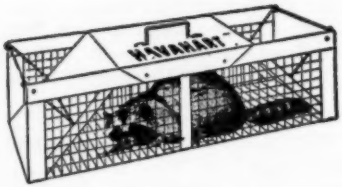

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